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USSR REPORT
ELECTRONICS AND ELECTRICAL ENGINEERING
No. 54

This serial publication contains articles, abstracts of articles and news items from USSR scientific and technical journals on the specific subjects reflected in the table of contents.

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CONTENTS	PAGE
AMPLIFIERS	1
Logarithmic Amplifier of Bipolar Signals With Large Dynamic Range	1
Design of Correcting Circuits for a Wideband DC Amplifier with Parallel Channels	1
ANTENNAS	2
Theoretical Basis for Experimental Investigation of the Properties of Diffraction Gratings	2
Application of the Averaged Boundary Conditions Method to the Solution of the Problem of Diffraction on a Thin Dielectric Thread Grating	2
Automatic Control of the Directivity of a Short-Wave Receiver Antenna	3
Antenna Design as a Function of Specified Amplitude Pattern and the Attendant Problems of Quasi-Optics (Review)	4
Antenna Arrays with a Wide Scan Sector	5
Axisymmetric Excitation of a Spherical Helical Antenna with a Conical Shield	5
A Nonaxisymmetric Antenna Equipped with a Beam Guide	6
Calculation of the Maximum Electric Field Intensity Along Short-Wave Feeder Lines	6

CONTENTS (Continued)	Page
CERTAIN ASPECTS OF COMPUTER HARD AND SOFTWARE; CONTROL, AUTOMATION, TELEMCHANICS AND MACHINE PLANNING	7
Evaluating the Parameters of Automated Electric Drives for Shipboard Systems	7
A Piezoelectric Stepper Motor for Discrete Driving on Data Carrier Tapes	8
Multifunction Logic Probe	8
CERTAIN ASPECTS OF PHOTOGRAPHY, MOTION PICTURES AND TELEVISION	9
Television Automat "STARK" for Checking of Complex Components ..	9
A Very High Frequency Television Transmitter with a Power of 50.10 kW	9
State of the Art and Development Trends in Professional Lighting Techniques for the Motion Picture Industry	10
Olympic Television-Radio Complex: Principles of Television Broadcasting Technology	11
Nickel-Cadmium Batteries for the Electric Drive of a 1KSR-1M Motion Picture Camera	11
A Gyroscope Stabilizer for a Motion Picture Camera on a Moving Stand	12
COMMUNICATIONS, COMMUNICATION EQUIPMENT, NETWORKS, RADIOPHYSICS, DATA TRANSMISSION AND PROCESSING	13
Optimal Processing of Light Fields Distorted by a Turbulent Atmosphere	13
Acoustic-Optical Image Readout	13
Assuring Reliability of Transmission Systems in the East German Long Distance Network	14
A Compensation Method for Increasing the Separation Between Line Channels	15
Measurement of Load Levels Using a Digital Pulse-Code Modulation Signal	15
Algorithm of Digital Measurement of Orthogonal Components of a Signal	16
Time Distribution of the Overshoots of Vectorial Random Processes	16
Multidimensional Transfer Functions of Nonlinear Distributed Systems	17

CONTENTS (Continued)

Page

Lower Bound of the Number of Optimal Systems of Discrete Frequency Signals	17
The K-1020S Transmission System	18
The Automatic Production Telephone Network of the USSR Ministry of Power Engineering	19
Inclusion of Operational Reliability as a Factor in the Design of Lightning Protection for Communication Cables	19
Calculating the Number of Channels in Bypass Trunks	20
Tunable Switching Circuits with Probabilistic Constraints	20
'Mifistor' Devices in Space Switching Systems	21
Transmission of Discrete and Analog Data Over Cable Lines of Urban Telephone Networks	21
Extremal Automatic Tracking Systems for Earth Stations	22
Briefs	23
Zhitomir Automatic Telephone Station	23
Undelivered Telegram Results in Disciplinary Action	23
New Automatic Telephone Station	23
New Automatic Telephone Station in Belyy Klyuch	24
COMPONENTS AND CIRCUIT ELEMENTS, INCLUDING WAVEGUIDES AND CAVITY RESONATORS	25
Synthesis of Flat Dielectric Waveguides with a Limited Number of Propagated Modes	25
Solution of the Problem of Natural Waves by the Minimal Autonomous Element Method	25
Change in the Sign of Nonreciprocity for Wave Attenuation in a Semiconductor-Containing Waveguide	26
Effect of Higher-Order Wave Types on Wave Attenuation in a Semiconductor-Containing Waveguide	27
Numerical Investigation of the Propagation Constants of Symmetrical Magnetic Waves in a Circular Corrugated Waveguide ..	27
Calculation of the Dispersion Characteristics of a Helix Surrounded by a Dielectric Pipe and a Longitudinally Ribbed Screen	28
Application of the Minimal Autonomous Element Method to Problems of Diffraction of Dielectric and Gyromagnetic Cylindrical Rods in a Waveguide (Inclusive of the Ferromagnetic Resonance Case)	29

CONTENTS (Continued)	Page
Analysis of a Frequency Shift Mixer Based on a Diode With Many-Valley Electron Transfer	29
CONFERENCES	31
Coordination of Development Activities Pertaining to Digital Television in the Soviet Union	31
CONVERTERS, INVERTORS, TRANSDUCERS	32
Combined Nanosecond Analog-Digital Converter	32
New Methods of Construction of Quick Acting Analog-Digital Converters	32
Designing of Follow-Up Analog-Digital Converters	33
CRYOGENICS AND SUPERCONDUCTIVITY	34
Properties of Externally Pumped Josephson Junctions	34
Analysis of Operation of Superconducting Quantum Interferometers in the Hysteresis Mode	34
ELECTRICAL ENGINEERING EQUIPMENT AND MACHINERY	36
On Damping of the Slot Leakage Flux in the Stator Winding of Surge Generators	36
Calculating a Pulse Voltage Spiral Generator	36
Evaluating the Quality of Multi-Speed Windings of Electric Motors	37
Some Problems in Diagnosing the Thermal State of Electrical Machines	38
Problems of Contacts in the Design of Electrical Power Apparatus	38
Reliability Analysis of a Thyristor Power Pack for Transformer Switching	39
ELECTROMAGNETIC WAVE PROPAGATION; IONOSPHERE; TROPOSPHERE; ELECTRODYNAMICS	40
Diffusion of Pulsed Magnetic Field Through a Screen Located in the Vicinity of a Massive Ferromagnetic Body	40
Spectrum Separation Method in the Problem of the Two-Dimensional Motion of Charged Particles in a Strong Magnetic Field .	40
Theory of Slow Electromagnetic Waves in a Conducting Jet	41
ELECTRON TUBES; ELECTROVACUUM TECHNOLOGY	42
Trajectories of Electrons in a Magnetron at Cyclotron Resonance	42

CONTENTS (Continued)	Page
GENERAL CIRCUIT THEORY AND INFORMATION	43
Nondegenerate Single Frequency Regeneration in Externally Pumped Parametric Systems	43
Planar Acoustooptical Modulator-Deflector Using the Space Harmonics of a Two-Phase Piezoelectric Transducer	43
Adaptive Compensation of Nonlinear Distortions:	44
On the Possibility of Reducing the Frequency of False Alarms ..	45
INSTRUMENTS, MEASURING DEVICES AND TESTORS; METHODS OF MEASURING	46
Time of Establishment of Oscillations in Digital Frequency Synthesizers	46
A Method of Protecting of Automatic Testing and Diagnosis Apparatus and a Logical Unit Being Tested From Current Overloads	46
Potentiometric Discrete Phase Shifter	47
Methods of Comparison of Phase Signals Reproduced at Different Frequencies	47
MICROELECTRONICS	49
Development of Thick-Film Hybrid Integrated Circuit Packages ..	49
OSCILLATORS, MODULATORS, GENERATORS	50
Nonlinear Nonstationary Theory of Diffraction Radiation Generators	50
A Pseudorandom Pulse Sequence Generator Operating at 140 Mbit/s	50
PHOTOELECTRIC EFFECT	52
Avalanche Photodiode as a Pulsed Radiation Recorder	52
POWER SYSTEMS	53
Optimization of Development of an Electrical Network on the Basis of the Method of Branches and Boundaries	53
PULSE TECHNIQUES	54
Synthesis of Frequencies on the Basis of Formation of Quasi- Meanders	54
QUANTUM ELECTRONICS	55
Laser Effect in an Active Longitudinally Inhomogeneous Medium of a Special Form in the Absence of a Mirror Resonator .	55
Adjustable Submillimeter Radiation Attenuator Based on VO ₂ Films	56

CONTENTS (Continued)	Page
RECEIVERS AND TRANSMITTERS	57
High-Power Shortwave Radio Broadcast Transmitter	57
SEMICONDUCTORS AND DIELECTRICS	58
Longitudinal Oscillation of a Semiconductor Plasma with a Low Concentration of Charge Carriers in Crossing Fields	58
Microwave Field-Induced Generation of Low Frequency Electro- magnetic Oscillations by Semiconductor Diodes	58
Polish Transistors and Microcircuits	59
THEORY	60
Buildup of Perturbations with a Limited Amplitude Spectrum	60

USSR

UDC 621.375.2:681.3

LOGARITHMIC AMPLIFIER OF BIPOLAR SIGNALS WITH LARGE DYNAMIC RANGE

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 8, 1979 p 53

LEVINSON, F. A., IVANOVA, YE. A., MOROZOV, L. A. and SHISHKIN, A. N.

[Abstract] The paper considers a logarithmic amplifier of bipolar signals, constructed on the base of six transistors and two microcircuits. The amplifier is characterized by simplicity of production and tuning. It uses the principles of pseudologarithmic amplification with parallel summation of signals incoming from the outputs of two logarithmic stages, each of which is constructed according to the principle of an actual logarithmic amplifier. A schematic diagram of the amplifier is presented and its method of operation is described. Figures 2; references 3 (Russian).

[8-6415]

USSR

UDC 621.375.124

DESIGN OF CORRECTING CIRCUITS FOR A WIDEBAND DC AMPLIFIER WITH PARALLEL CHANNELS

Moscow ELEKTROSVYAZ' No 8, Aug 79 pp 61-63 manuscript received 17 May 77

ARTEM'YEVA, L. S. and MAKAROVA, A. A.

[Abstract] A wideband amplifier can be constructed as a combination of two parallel amplification channels--a dc amplifier-double input signal transformation channel and an ac narrow-band amplifier. A structural diagram of such an amplifier is presented. The main difficulty which arises in the process of development of an amplifier is assurance of frequency and phase matching of the channels, i.e., a frequency characteristic of the entire amplifier which is uniform over the entire frequency band. The frequency-phase characteristics of the channels are strictly interrelated, i.e., a frequency characteristic of the entire amplifier which is uniform over the entire frequency band. The frequency-phase characteristics of the channel are strictly interrelated, and one of the characteristics can be used to determine the other. Examples are presented of the calculation of the frequency characteristics of matching devices based on a low-frequency filter connected in the input signal transformation circuit. The results of the article can be used to develop wideband dc amplifiers made with parallel channels assuring uniform frequency characteristics throughout the entire assigned operating frequency range. Figures 5; references 2 (Russian).

[19-6508]

USSR

UDC 535.853.31

THEORETICAL BASIS FOR EXPERIMENTAL INVESTIGATION OF THE PROPERTIES OF DIFFRACTION GRATINGS

Gorkiy IZV. SOUZ: RADIOFIZIKA in Russian Vol 22 No 9, Sep 79 pp 1109-1116
manuscript received 28 Aug 78

IVANCHENKO, D. D., KOLCHIGIN, N. N., LITVINENKO, L. N., PROSVIRNIN, S. L.
and REZNIK, I. I., Institute of Radiophysics and Electronics, Ukrainian SSR
Academy of Sciences

[Abstract] A theoretical model of an experiment is constructed with all necessary conditions for accurately determining the transmission coefficient and the amplitudes of harmonics in a periodic diffraction grating. This model includes parameters of the grating geometry and of the field distribution, the latter approximated by a rectangular step wave with almost negligible oscillations on top. The validity of this model has been confirmed experimentally, namely experimental data for a grating with a finite number of active elements are fast approaching theoretical data for an infinite grating excited by a plane wave. Furthermore with an increasing number of passive elements, the error of measurements at the diffraction peaks also decreases rapidly. This applies to diffraction gratings shielded either on the side of the incident wave or on the side of the receiver antenna. Figures 5; references 3 (Russian).

[51-2415]

USSR

UDC 537.874.6:621.396.677.49

APPLICATION OF THE AVERAGED BOUNDARY CONDITIONS METHOD TO THE SOLUTION OF THE PROBLEM OF DIFFRACTION ON A THIN DIELECTRIC THREAD GRATING

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24 No 8, 1979 pp 1660-1662
manuscript received 26 Dec 77

ASTRAKHAN, M. I.

[Abstract] The averaged boundary conditions (ABC) method, previously applied to metal gratings, is now applied to a grating made of thin dielectric cylinders, and the diffraction properties of this grating are investigated. It is shown that the ABC method is then applicable if various constraints on the incident E- and H-polarization waves are observed. Then the averaged boundary conditions link the tangential component of electrical field intensity in the plane of the grid to the value of the smoothed current. The reflection

factor of the dielectric grid is markedly lower than that of the metal grid of the same dimensions; the phase of the reflection factor is a function of the ratio between the dielectric constants of the medium and the grating. Experimental verification of reflections from a dielectric-rod grating in a waveguide excited by a H_{01} wave demonstrated a satisfactory fit with the presented calculations. The proposed procedure makes it possible to analyze the diffraction of electromagnetic waves on two and more parallel dielectric-thread gratings with the aid of analogous findings previously reported for metal gratings. Moreover, the averaged boundary conditions derived in this paper can also be used in the solution of problems in which the dielectric-thread grating (or a homogeneous thin sheet of a dielectric) forms a slightly curved surface. Figures 9: 8 Russian, 1 Western.
[22-1386]

USSR

UDC 621.396.67

AUTOMATIC CONTROL OF THE DIRECTIVITY OF A SHORT-WAVE RECEIVER ANTENNA

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 79 pp 13-16 manuscript received 8 Oct 78

MASLOV, O. N.

[Abstract] The directivity of uncontrolled short-wave receiver antennas is already nearly extreme and, therefore, limits their performance under conditions where incoming signals vary in time and space. Further narrowing of the radiation pattern is not expedient in this case, but its automatic adaptive control with a "fan-out" has been found to be very effective. Here such a system is shown which consists of a scanning channel and an operating channel. A modification of a "traveling wave" antenna with a longitudinal quad array was experimentally tested with this system for inaccuracy, i.e., number of distortions over some period of time and frequency of distortions above some level. An appreciable advantage over a conventional "traveling wave" antenna has been established in both absolute and relative terms. Diverse statistical characteristics of reception lobes in the vertical plane, attainable with the "fan-out," make the use of more intricate systems for simultaneous instantaneous automatic selection feasible. Figures 2; tables 3; references 6 (Russian).
[38-2415]

ANTENNA DESIGN AS A FUNCTION OF SPECIFIED AMPLITUDE PATTERN AND THE
ATTENDANT PROBLEMS OF QUASI-OPTICS (REVIEW)

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian No 8, 1979 pp 1485-1500 manu-
script received 19 Apr 78

VOYTOVICH, N. N. and SAVENKO, P. A.

[Abstract] Problems of the theory of antenna design as a function of the specified radiation amplitude pattern are reviewed. The optimization criterion applied to these problems is a functional representing the sum of the r.m.s. deviation of antenna-pattern modules and the fraction of power propagating outside the specified angle. A numerical analysis of the design of linear antenna and antenna arrays is presented. The approach used assures an effective solution of various problems of antenna design as a function of the specified radiation amplitude pattern. For emitting systems with sufficiently large electrical parameters these problems have, as a rule, a non-unique solution. The number of solutions and their properties are determined analytically, which makes it possible every time to find the global extremum of the functionals in question. The problems are solved with the aid of a computer with the use of the method of successive approximations. The review also extends to related problems of quasi-optics for which the freedom of choice of the phase pattern results in non-uniqueness of solution. In the mathematical plane this non-uniqueness results in that the variational problem is equivalent to some nonlinear integral or integrodifferential equation having, as a rule, a non-unique solution. Figures 9; references 35 (Russian).

[22-1386]

ANTENNA ARRAYS WITH A WIDE SCAN SECTOR

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 79 pp 1-5 manuscript received 11 Mar 79

BELOUSOV, S. P., GUREVICH, R. V. and KLIGER, G. A.

[Abstract] An antenna array is described which consists of plane vibrators and has a radiation pattern controllable over a scan sector as wide as $\pm 30^\circ$. This SGDP-RA antenna operates in the transverse radiation mode and has been designed on the basis of the "self-complementation" principle where each element of the array comprises a slot radiator and an electric radiator of identical configurations connected in parallel. Their input impedance is of the order of 240Ω and varies within narrow limits over a wide operating range. The radiation pattern is nearly synphasal in the vertical plane and the side lobes in the horizontal plane do not exceed $0.4E_{\max}$ in the short-wave $(0.7-1.4)\lambda_0$ range. The feeder system and the performance characteristics are shown as well as the simplified insulation between antenna sections with rigid supports and rigid vibrators. The antenna can be used for simultaneous operation with two transmitters. With development and design completed, the system is ready for installation. Figures 10; references 3 (Russian). [38-2415]

AXISYMMETRIC EXCITATION OF A SPHERICAL HELICAL ANTENNA WITH A CONICAL SHIELD

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 22 No 9, Sep 79 pp 1124-1130 manuscript received 18 Oct 78

BELICHENKO, V. P. and GOSHIN, G. G., Siberian Physicotechnical Institute affiliated with (pR1) Tomsk State University

[Abstract] Helical antennas wound around a spherical surface are used as wideband antennas with elliptical polarization, either slightly directional or, with a proper shield, highly directional. Here the performance of such antennas with conical shields is analyzed theoretically. The antenna is treated as an anisotropic conducting medium, with the excitation coming from a vertical electric dipole. The shield is assumed to be infinitely long and ideally conducting. The problem is treated as a two-dimensional boundary value problem and solved by expansion into a series with respect to complete orthogonal systems of functions which satisfy the boundary conditions at the shield surface. On this basis, then, radiation patterns are calculated for various typical values of antenna, shield and excitation parameters. Figures 5; references 7: 2 Russian, 5 Western. [51-2415]

USSR

UDC 621.396.677.83:621.396.946.2

A NONAXISYMMETRIC ANTENNA EQUIPPED WITH A BEAM GUIDE

Moscow ELEKTROSVYAZ' in Russian No. 9, Sep 79 pp 6-9 manuscript received 19 Jan 78

BASILAYA, I. SH. and POKRAS, A. M.

[Abstract] Although axisymmetric ground antennas have the excellent electrical characteristics needed for satellite communication systems, further performance improvement is not feasible because of the shading effect of the counter-reflector and parasitic back reflection into the radiator. This obstacle has been overcome by departing from axial symmetry in an antenna with its conical horn radiator outside the aperture, with a parabolic main reflector and a hyperbolic counter reflector. Furthermore, two auxiliary reflectors forming a beam guide have been inserted between the horn radiator and the two principal reflectors. Here additional profiling of both these reflectors is proposed, on the basis of an approximate analysis regarding conversion of a plane wave from a spherical one in the transmitter antenna and to a spherical one in the receiver antenna. Rough estimates based on design calculations indicate a higher surface utilization factor and lower noise temperatures than in an axisymmetric antenna. The authors thank N. L. MAKSIMOV for plotting the experimental radiation patterns. Figures 6; references 7: 5 Russian, 2 Western. [38-2415]

USSR

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CALCULATION OF THE MAXIMUM ELECTRIC FIELD INTENSITY ALONG SHORT-WAVE FEEDER LINES

Moscow ELEKTROSVYAZ' in Russian No. 9, Sep 79 pp 10-13 manuscript received 26 Jan 78

KUZNETSOV, V. D. and KOMISSAROV, V. I.

[Abstract] A short-wave feeder line is considered which consists of parallel small cylindrical conductors symmetrically spaced around a large circle or several concentric circles in cross section, in the extreme case consisting of only two or four such conductors. The electric field intensity at any conductor is calculated as the sum of that due to its own charge and that due to the charges of all other conductors, taking into account the non-uniform current distribution over the array. The results indicate that the maximum electric field intensity can be much higher than if the current were uniformly distributed over the array. Numerical data are shown for a feeder line with the characteristic impedance equal to 276Ω. Figures 8; reference 1 (Russian). [38-2415]

USSR

UDC 62-83.531.3.001.24

EVALUATING THE PARAMETERS OF AUTOMATIZED ELECTRIC DRIVES FOR SHIPBOARD
SYSTEMS

Moscow ELEKTRICHESTVO in Russian No 8, Aug 79 pp 64-68 manuscript received
2 Feb 78

FREYDZON, I. R., BULATOV, V. I., SEMUKHIN, YU. A. and YAURE, A. G.

[Abstract] It is shown that complex machine investigation and design of automatized electric drives (AEP) based on the use of computers makes it possible comparatively quickly to solve the problem of analysis with a minimum expenditure of manual labor. On the basis of an analysis of the results obtained an electric drive with optimum parameters is selected, and the effect is determined of the system parameters of the AEP on the processes occurring. Machine investigation and design includes conducting a combination of work, fulfillment of which makes it possible to enter raw data into the computer in the form in which they occur in a technical setting. It is necessary during it to distinguish three basic stages of work: software of the problem, input of raw data and output of finished results; processing of the information obtained and choice of the subsequent calculated variations. A block diagram of one of the versions under consideration for machine investigation and design for shipboard systems is presented, as well as a generalized block diagram of an algorithm of the plan of a ship with an anchor. The proposed algorithm of machine investigation was used for solution of the problem of the control of the electric drive of an anchor-handling gear and a choice of the optimum rate of vibration of the anchor chain and the starting moment of the driving electric motor during release of the ship from the anchor. Investigations are conducted which show that the use of a method proposed in the paper for calculation of the parameters of a complex "ship-anchor--anchor-mechanism makes it possible more effectively to use an actuating motor. Figures 5; references 3 (Russian).

[9-6415]

USSR

UDC 621.313

A PIEZOELECTRIC STEPPER MOTOR FOR DISCRETE DRIVING ON DATA CARRIER TAPES

Leningrad IZV. VUZ: PRIBOROSTROYENIYE in Russian Vol 22 No 8, Aug 79 pp 30-33 manuscript received 9 Sep 78

GURBANOV, T. B. and GUSEYNOV, A. M., Department (Kafedra) of Electrical Machines and Drives, Azerbaijan Polytechnic Institute imeni Ch. Il'drym

[Abstract] Piezoelectric stepper motors feature high thermal stability and step uniformity, without intrinsic magnetic fields and with the ability to operate under low pressure. Here such a stepper motor for transporting data carrier tapes is described which essentially consists of two rectangular 2-ply plates, each with a layer of steel and a layer of piezoceramic glued or welded together, and two friction pads between which the tape moves. The operation of this motor is analyzed, assuming a periodic d.c. voltage across its terminals. The design is determined by the performance requirements and on the basis of experimental data, with reliability under shock and vibration a very important parameter. The paper was recommended by the Department (Kafedra) of Electrical Machines and Drives, Azerbaijan Polytechnic Institute imeni Ch. Il'drym. Figures 4; references 4: 3 Russian, 1 Western. [54-2415]

USSR

UDC 621.382

MULTIFUNCTION LOGIC PROBE

Moscow PRIBORU I SISTEMY UPRAVLENIYE in Russian No 8, 1979 pp 35-36

ODINTSOV, A. A. and ADOYAN, YE. A., engineers

[Abstract] The paper considers a logic probe with expanded functional possibilities intended for analysis of signals in discrete devices. The structural scheme and principles of action of the probe are described. The probe was developed at the Institute of Control Problems (Moscow). Figures 1; tables 1; references 2 (Russian).

USSR

UDC 621.3.019.3:681.2

TELEVISION AUTOMAT "STARK" FOR CHECKING OF COMPLEX COMPONENTS

Moscow IZMERITEL'NAYA TEKNIKA in Russian No 8, 1979 pp 25-26

SUMINOV, V. M. and GREBNEV, A. A.

[Abstract] The experimental technological unit "STARK" (self-instructing television automat for dimensional checking) has been created as one of the stages in the necessary overall evaluation of the shapes of the complex profiles of precision components. For practical realization of the procedures involved, algorithms for a specialized computing system were developed (Suminov, V., et al. Tekhnika Kino i televideniya, 1976, No 3), which make it possible to use television-computing techniques. A block diagram of the unit for realization of the algorithms of instructions and classifications is shown, the operation of the unit is explained and its specifications are listed. At present, on the basis of the unit developed, construction of series-produced specimens of automats for solution of concrete problems of industry is accomplished at a number of instrument making enterprises. Figures 1; references 2 (Russian).

[8-6415]

USSR

UDC 654.19

A VERY HIGH FREQUENCY TELEVISION TRANSMITTER WITH A POWER OF 50/10 kW

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 79 pp 17-20 manuscript received 2 Apr 79

BARABASH, V. I., MATSIYEVSKIY, A. S., RACHINSKIY, S. V. and FAYNSHTEYN, A. L.

[Abstract] A television transmitter has been built for broadcasting in the third frequency band (174-230 MHz). Its performance characteristics are better, its size is smaller, and its reliability is higher than those of existing VHF television transmitters with a comparable power. High reliability is attained by paralleling two half-power stages containing each a picture channel and a sound track, with a common voltage supply, a common cooling system, and a common video amplifier. Furthermore, each stage includes a modulator, appropriate frequency converters, and a frequency signal generator which ensures high stability of audio and video carrier frequencies (within 150 kHz). The transmitter is built with essentially standard components, improved to meet modern requirements, the amplifiers in the picture channels and in the sound tracks being completely transistorized. The peak video power is 50 kW,

the peak audio power is 10 kW. The transmitter can operate at ambient temperatures from 5 to 40°C and is ready for installation in the USSR network. Figures 5; references 2 (Russian).

[38-2415]

USSR

UDC 771.44+791.44.022:771.44

STATE OF THE ART AND DEVELOPMENT TRENDS IN PROFESSIONAL LIGHTING TECHNIQUES FOR THE MOTION PICTURE INDUSTRY

Moscow TEKNIKA KINO I TELEVIDENIYA in Russian No 9, Sep 79 pp 34-39

GLADYSHEV, V. I., ZEMTSOVA, N. F., KURITSYN, A. M., PELL', V. G. and SEMENIKHIN, N. T.

[Abstract] Developments in professional lighting, an integral part of film production, have been keeping pace with the overall progress of the motion picture industry. Important contributions are made by "Mosfil'm," Lenfil'm," the Central Studios of Documentary Film Making imeni A. M. Gorkiy and imeni A. P. Dvozhenko, as well as by the All-Union Scientific Research Institute of Cinematography in collaboration with the "Ekran" Scientific-Industrial Association. Specific achievements include a series of halogen-filled incandescent quartz lamps with power ratings from 150 W to 10 kW, all operating at a filament temperature of 3200-3250 K, and a series of metalhalogen lamps of a similar power range. The latter need still further improvement in order to match the performance of incandescent lamps in terms of fast warm-up and elimination of flicker. They have better luminous and energy characteristics, and both kinds of lamps being suitable for directionally diffuse and shadowless lighting. Other achievements include appurtenances such as projectors with Fresnel lenses or with mirror optics, various stands, frames, adapters and brightness trimmers. Underway are further improvements in independent voltage sources and in automatic remote control of the camera equipment. Tables 3.

[37-2415]

USSR UDC 778.5:621.397.13:796.092+621.397.6:796.092+621.396.97:796.092

OLYMPIC TELEVISION-RADIO COMPLEX: PRINCIPLES OF TELEVISION BROADCASTING TECHNOLOGY

Moscow TEKHNKA KINO I TELEVIDENIYA in Russian No 9, Sep 79 pp 49-54

KOCHUASHVILI, K. Z., MEL'BERG, A. M. and SHABSKIY, K. K.

[Abstract] The joint television and radio complex for coverage of the 1980 Olympic Games consists of field and station equipment with appropriate communication channels between them. The field equipment covers the stadia as well as sportscaster booths and mobile outposts, also necessary relay and transmission apparatus. Video and audio signals are monitored at the Center, where also facilities for recording and playback are available. The television station can handle 20 different programs and accommodate simultaneously 100 commentators in 70 booths, the radio station operates with equipment organized in 70 studios. There is, furthermore, an internal television network available for the press and a communication network for service and maintenance functions. Installation of the Center, which was begun in the fall of 1976, should be completed shortly. It will operate with a total power of 10,000 kVA. An air conditioning system with a capacity to move 1,000,000 m³ of air per hour will be provided for the comfort of the personnel working inside the Center. Figures 4; references 1 (Russian). [37-2415]

USSR

UDC 778.533.6:621.355.82

NICKEL-CADMIUM BATTERIES FOR THE ELECTRIC DRIVE OF A 1KSR-1M MOTION PICTURE CAMERA

Moscow TEKHNKA KINO I TELEVIDENIYA in Russian No 9, Sep 79 pp 55-59

NIKUL'SKIY, YE. V., NIKITIN, V. V., NIKITIN, A. V. and KHAR'KOV, YU. M., Leningrad Studio of Documentary Film Making

[Abstract] Research done on replacement of silver-zinc batteries with more reliable, sturdy and stable, also less costly, voltage sources for the DPM-35 constant-speed electric drive with a 15EPSS tachometer of a 1KSR-1M "Konvas-Avtomat" motion picture camera has resulted in the development of a special-purpose pack of nickel-cadmium batteries. They last for 10-15 days or 1000-1500 m of film without booster charging. The basic configuration is a sealed assembly of 20 NKG-1.5 cells delivering 21-29 V, 24 V at a nominal current, designed for minimum size and maximum convenience. It comes with either of two electronic circuits: a very simple servo control with pulse width modulation and retention of the motor performance characteristics, or

a more intricate one with speed stabilization through a quartz oscillator for maintenance of synchronism. Miniaturization of the electronics has been achieved by packaging all components on two boards and by maximum possible integration of the modulator, the logic, the operational amplifier, the stabilizer, and other components. Both motor speed and battery charge are controlled, also protection against polarity reversal has been provided. In addition, an encoder including a multivibrator and a scaler is available for recording the beginnings and the ends of camera scan cycles, i.e., starts and stops of motor operation so that the battery can be disconnected instead of being idly drained. Figures 5.
[37-2415]

USSR

UDC 778.53-752.4

A GYROSCOPIC STABILIZER FOR A MOTION PICTURE CAMERA ON A MOVING STAND

Moscow TEKHNIIKA KINO I TELEVIDENIYA in Russian No 9, Sep 79 pp 22-25

BUDKIN, V. L., MELAMED, YU. I., MUN'KIN, V. B. and FATEYEV, V. V., All-Union Scientific Research Institute of Cinematography; Moscow Higher Technical School imeni N. E. Bauman

[Abstract] Modern techniques in cinematography include picture taking with a camera which rides on a moving stand. In this case, with a large distance from the object characteristically maintained, degradation of the picture quality is avoided by the use of objectives with large and widely variable focal lengths. Such a camera must be stabilized against its random vibratory motion on the stand, a combination of linear and angular displacements. Here a triaxial gyroscopic indicator stabilizer is described which has been optimally designed for an IKSR-2M motion picture camera with a remotely controllable 35 OPF-15 objective and television view finding. It is essentially a 3-stage gyroscope with an inductive high-frequency 2-coordinate angle transducer on each of the three axes, followed by a power amplifier with pulse-width modulation and a low-friction 1:1 torque transducer on the stabilization axis. Meanwhile, both horizontal and vertical scanning is stabilized by means of an inertial mass in the form of a flywheel with the axis of rotation parallel to the stabilization axis. Furthermore, automatic vertical and horizontal balancing stabilizes the platform while the center of gravity of the camera and thus the optical components of the latter change position during picture taking. The system features a high precision of the order of $4''$ at a $10-15''/s$ scanning rate, after a fast warm-up and starting time within 20 s, and ensures a high quality of pictures taken by objectives with a typical focal length of 500 mm. Figures 1; references 4: 3 Russian, 1 Western.
[37-2415]

USSR

UDC 551.511.6:621.391.27

OPTIMAL PROCESSING OF LIGHT FIELDS DISTORTED BY A TURBULENT ATMOSPHERE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24 No 8, 1979 pp 1501-1506
manuscript received 24 Jul 78

BAKUT, P. A., SVIRIDOV, K. N., TROITSKIY, I. N. and USTINOV, N. D.

[Abstract] The optimal processing of light fields distorted by a turbulent atmosphere in the presence of a high signal/noise ratio is discussed for the case of the observation of an extended source of noncoherent wideband radiation. It is shown that then for a fixed function of atmospheric phase fluctuations the field at the inlet aperture of the telescope represents a stable normal random process with a zero mean and a specific correlation function. The derived likelihood functional can be construed in a twofold manner from the standpoint of the physical interpretation of the optimal operations resulting in its maximization. In the first case, optimal processing consists in partitioning the entire frequency range of the recorded radiation into discrete central-frequency domains, with subsequent matched filtration of the frequency spectrum of the recorded radiation in these domains. In this case optimal processing is concluded with adaptive tuning of active optical elements in the discrete frequency domains. In the second case, optimal processing consists in an analytic solution of the pertinent equation. On the basis of the conducted synthesis it can be concluded that in the presence of a high signal/noise ratio the adaptive processing of atmospherically distorted light fields is the optimal form of processing. Figures 3 (Russian).
[22-1386]

USSR

UDC 621.37/39:534

ACOUSTIC-OPTICAL IMAGE READOUT

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24 No 8, 1979 pp 1621-1629
manuscript received 13 Jul 78

BALAKSHIY, V. I. and PARYGIN, V. N.

[Abstract] Design calculations for an image readout system based on the principle of acoustic-optical interaction are presented. Formulas for the basic characteristics of such a system as a function of the parameters of the acoustic-optical cell are derived. The calculations are verified for the case of an acoustic-optical image readout system based on a PbMoO_4 crystal. It is shown that then one image line can be scanned in 11.2 microsec.

Accordingly, such a system can assure image readout at the rate of $81 \cdot 10^6$ elements/sec. Analysis of the problems of optimizing system parameters shows that the best performance is displayed by devices operating in a region in between Raman and Bragg diffractions. Thus the calculations show that the acoustic-optical image readout system assures a high resolution and rapid rate of line scan. It is simple in design, small, highly sensitive and can operate within a broad range of light wavelengths. Figures 4; references 5: 3 Russian, 2 Western.
[22-1386]

USSR

UDC 621.39

ASSURING RELIABILITY OF TRANSMISSION SYSTEMS IN THE EAST GERMAN LONG DISTANCE NETWORK

Moscow ELEKTROSVYAZ' No 8, Aug 79 pp 9-11 manuscript received 12 Dec 78

KUKE, HANS, SCHUPPLER, HORST and KALYUZHNYI, V. F.

[Abstract] Methods of maintenance of communication transmission equipment are discussed. A combined preventive and repair system is suggested for modern communication equipment. The results of long-term testing have confirmed the applicability of statistical methods for analysis of the condition of communication apparatus, which can then be used to develop recommendations for effective communication hardware maintenance schedules. The use of statistical testing leads to an increase in the productivity of maintenance personnel while decreasing noise and communication failures in the system. Automatic devices for statistical testing of the quality of channels and lines are to be introduced in stages in East Germany. Figures 3; tables 1; references 6: 3 Russian, 3 Western.
[19-6508]

USSR

UDC 621.315.17

A COMPENSATION METHOD FOR INCREASING THE SEPARATION BETWEEN LINE CHANNELS

Moscow ELEKTROSVYAZ' No 8, Aug 79 pp 19-22 manuscript received 22 Oct 77

VERNIK, S. M.

[Abstract] The compensation method of interference suppression can increase the separation between channels on a cable line and thus significantly increase the quality of communication and its overall effectiveness. The essence of the compensation method is that special compensation devices connected between lines are used to create compensation emf, which weaken the mutual influence between circuits. An instrument called the DIP-552 is described, which was developed at the Leningrad Electrotechnical Institute of Communications and series produced by the EPM (expansion unknown) of the Institute since 1976. The DIP-552 is used to measure the transfer function of mutual interference between two channels on a line in the 20-552 kHz band. A system of automatic or semiautomatic testing of mutual interference is needed to further improve the effectiveness of the compensation method of suppression of mutual interference between lines. The author thanks V. B. Rudnitskiy, B. K. Gushin, B. K. Nikitin, A. M. Kuznetsov, and N. M. Kurshev the creative work of whom assisted development and introduction of the method discussed for an increase of the separation on cable lines, and the creation and manufacture of DIP. Figures 3; references 4 (Russian).
[19-6508]

USSR

UDC 621.317.7:621.376.56

MEASUREMENT OF LOAD LEVELS USING A DIGITAL PULSE-CODE MODULATION SIGNAL

Moscow ELEKTROSVYAZ' No 8, Aug 79 pp 15-18 manuscript received 20 Jan 77

NIKIFOROV, N. P., KAMLET, S. G., TSIKLIS, A. M. and SHPIGEL', A. R.

[Abstract] A study is made of a method of measurement of the overload level using a sine-filled pulse signal with a fixed level exceeding the overload level. The new method is easier to automate than existing methods, more accurate, and does not require precise selection of the pulse signal level. A block diagram of a device for measurement of overload levels is presented. The operation of the device is briefly explained. Figures 4; tables 1; references 6: 5 Russian, 1 Western.
[19-6508]

USSR

UDC 621.317.757:621.372.54.037.372

ALGORITHM OF DIGITAL MEASUREMENT OF ORTHOGONAL COMPONENTS OF A SIGNAL

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 8, 1979 pp 20-21

MALYKIN, M. I., BARASHKOV, M. M. and GNUCHEV, YU. P.

[Abstract] The increasing use of digital filtration and measurement of the parameters of signals is caused by the rapid development of microelectronics and the merits of digital methods in comparison with analog. However, the complexity of digital circuits and the additional errors connected with the discreteness of representation of signals remain a problem requiring a solution. The present paper considers an algorithm of digital filtration and measurement of the amplitude and phase of a signal, reduced to a change of its orthogonal components. The algorithm made it possible to exclude the operation of forming the codes for discrete sampling of support functions and multiplication of them with the codes of the sampling signal. In so doing the indicated operations are replaced by an algebraic summation of the codes of the sampling signal, and samplings of the support functions are described by their absolutely precise values, and the error caused by the discrete representation of the sampling of support functions is absent. A device for achieving the algorithm is discussed and a block diagram is presented. Figures 2; references 2 (Russian).

[8-6415]

USSR

UDC 621.391.2

TIME DISTRIBUTION OF THE OVERSHOOTS OF VECTORIAL RANDOM PROCESSES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24 No 8, 1979 pp 1688-1692
manuscript received 17 Oct 77

BABUSHKIN, YE. F.

[Abstract] An extension of the boundary intersection problem to vectorial random processes is described. Such a problem arises in the solution of problems in which the vector components may be randomly varying parameters of system elements or of the useful and noise signals. A formula for the time distribution density of the overshoots of the vectorial random process is derived. It has the form of an infinite series whose terms are represented by surface integrals of increasing multiplicity, and hence these terms are computed with the aid of the techniques of k-connected representation of events A_1 such that the multiplicity of the integrals does not exceed k. References 5 (Russian).

[22-1386]

USSR

UDC 621.391.2

MULTIDIMENSIONAL TRANSFER FUNCTIONS OF NONLINEAR DISTRIBUTED SYSTEMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24 No 8, 1979 pp 1533-1541
manuscript received 13 Dec 76; after revision 18 Jan 79

YEGOROV, YE. A. and KABANOV, D. A.

[Abstract] A mathematical-structural model of a one-dimensional nonlinear distributed system (NRS) is constructed on the basis of the approximation of nonlinear operators with the aid of functional Volterre series. A method for deriving multidimensional transfer functions on the basis of the solution of systems of two inhomogeneous linear differential equations is presented. The transfer functions thus derived are used to investigate the properties of a distributed semiconductor diode detector of AM oscillations in the standing-wave mode. The findings of this study can be utilized to compute weakly nonlinear distributed systems and NRS with marked dispersion, i.e., cases in which attention can be confined to a small number of interacting spectral components. The presented model can be applied to the analysis of two- and three-dimensional media as well as to the case of distributed input effects. Figures 4; references 16: 12 Russian, 4 Western.
[22-1386]

USSR

UDC 621.391.2

LOWER BOUND OF THE NUMBER OF OPTIMAL SYSTEMS OF DISCRETE FREQUENCY SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24 No 8, 1979 pp 1692-1695
manuscript received 20 Jan 78

VARAKIN, L. YE.

[Abstract] Of the known discrete frequency (DF) signals those most commonly used are the so-called optimal signals whose autocorrelation and cross-correlation functions (ACF and CCF) do not have more than one coincidence. Optimal DF signals, whose pairs have not more than one coincidence, form an optimal system. In this connection the lower bound of the number of various optimal systems of DF signals is investigated. Coincidence here is construed as coincidence of elements of the frequency-time matrix (FTM) of two signals whatever their relative displacement in time. A sample FTM of a DF signal with the number of elements $M = 6$ is illustrated: each hatched square corresponds to a particular radio pulse and shows its position in

time and in frequency. A formula for the volume of optimal DF systems (number of signals) is presented. It is shown that the properties of the optimal DF system depend on the intervals between the signal elements. From the combinatorial standpoint, the formation of new optimal DF signal systems reduces the permutations of M signal elements, since permutations of M frequency rows of the FTM are performed. Hence, allowing for all the permutations, the number Q of various optimal DF signal systems will be no lower than $Q_{\min} = M!$ Thereby also the lower bound of the number of optimal DF signals is determined. Figures 2; references 6 (Russian). [22-1386]

USSR

UDC 621.391.3

THE K-1020S TRANSMISSION SYSTEM

Moscow ELEKTROSVYAZ' No 8, Aug 79 pp 12-15 manuscript received 9 Jan 79

KIM, L. T. and RAPOPORT, E. Z.

[Abstract] There are many balanced cable lines in the USSR over which K-60P multiplexing apparatus operates in the 12 to 252 kHz band. Up to 480 channels can be organized in a 4 x 4 cable using this equipment. As the needs for additional channels increase, this article suggests that it is best to set up additional frequency-separated channels in the frequency range above 252 kHz. For example, in the 0.3-5 MHz band, an additional 1000 channels or so can be created. The new K-1020S transmitting system is designed to utilize this band in order to create additional channels over the same lines currently being used by K-60P devices. Methods of operation and band allocation are described. The equipment has been tested over a 50-kilometer test sector in combination with a K-60P system. Figures 3. [19-6508]

USSR

UDC 621.395.37

THE AUTOMATIC PRODUCTION TELEPHONE NETWORK OF THE USSR MINISTRY OF POWER ENGINEERING

Moscow ELEKTROSVYAZ' No 8, Aug 79 pp 41-46 manuscript received 23 Nov 77

KARASIN, G. S.

[Abstract] Special communications networks have been set up in the Ministry for Power Engineering and Electrification of the USSR, utilizing high-voltage lines, cable and overhead communication lines and radio relay lines, to provide reliable communications for purposes of control of electric power generation and distribution networks of the country. Brief descriptions are presented of the central production telephone network of the Ministry, the production telephone network of the Central Power Distribution Administration, the production telephone networks of combined power distribution administrations' power systems and individual power distribution networks. The technical and economic effectiveness of the introduction of these automated telephone networks is estimated. Figures 2; references 1 (Russian).

[19-6508]

USSR

UDC 621.395.51:621.315(001.2)

INCLUSION OF OPERATIONAL RELIABILITY AS A FACTOR IN THE DESIGN OF LIGHTNING PROTECTION FOR COMMUNICATION CABLES

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 79 pp 56-59 manuscript received 10 Jul 78

KIRICHENKO, V. P. and GROMOVA, YE. A.

[Abstract] Service characteristics and, especially, reliability should be accounted for in the design of lightning protection for communication cables. Accordingly, the allowable number of dangerous strikes and the likely duration of storm activities have to be determined from meteorological data accumulated over as many as 15 years. It will then be possible to establish needed correlations and reliability indicators for consideration in the design, namely: the probable total number of defects building up over the entire cable length, the failure rate of an entire cable during a critical period, and availability factor, i.e., the ratio of failure-free operating time to total installed time. In addition, the interdependence of economic indicators characterizing cable protection and technical indicators characterizing cable performance must also be taken into consideration. It is recommended that the Guidelines for Lightning Protection of Underground Communication Cables be appropriately revised. Figures 3; references 2 (Russian). [38-2415]

USSR

UDC 621.395.74.001.24

CALCULATING THE NUMBER OF CHANNELS IN BYPASS TRUNKS

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 79 pp 29-32 manuscript received 5 Oct 78

ANTONOVA-SOLOV'YEVA, T. S., LEVINA, G. B. and LEZERSON, V. K.

[Abstract] Bypass trunks for handling all excess loads and light loads are an essential part of any interurban telephone network. Here the necessary number of channels in such a bypass trunk is calculated, using as a criterion the loss of signal fluxes relative to an appropriate standard norm. Results obtained by the method of equivalent substitutions are compared with those based on the Erlang formula without dispersion and are found to be more reliable. Recommendations by the International Telegraph and Telephone Consultative Committee are also found to be valid for networks of a limited scope only. Tables 2; references 10: 4 Russian, 5 Western, 1 Internat'l. [38-2415]

USSR

UDC 621.395.341

TUNABLE SWITCHING CIRCUITS WITH PROBABILISTIC CONSTRAINTS

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 79 pp 48-53 manuscript received 25 Oct 77

FIDLIN, YA. V.

[Abstract] A theory of tunable circuits which applies to free scanners is developed, such devices being needed for construction and selection of load concentrators in automatic telephone exchanges. Accordingly, multicascade switching fields are synthesized for free scanning with compression and the necessary s groups of constraint conditions for realizing a given s-cascade array of connections are established on the basis of topological analysis. Furthermore, this set of conditions is also proved to be sufficient. Losses of signal fluxes are then calculated, by a rigorous mathematical method, on the basis of an appropriate probability analysis. Figures 3. [38-2415]

'MIFISTOR' DEVICES IN SPACE SWITCHING SYSTEMS

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 79 pp 43-48 manuscript received 27 Feb 79

ZAKURDAYEV, A. V. and TUMANYAN, L. A.

[Abstract] Mifistors are new hydrocapillary mercury contacts of the liquid-metal type.* They have a low and stable contact resistance, no jitter, and a low noise level. A coordinate connector with such switch elements has been developed at the Moscow Engineering Physics Institute which features high reliability, high speed, and low energy consumption. It is suitable for use in communication systems, computing technics, automatics and in automated management systems (ASU) with computers where many and frequent connections between data sources and data users must be made. The performance characteristics of mifistors compare favorably with those of Gerkon sealed reed switches. Typical stereocommutator configurations are shown and the functioning of these switches in a typical operation is explained. Figures 4; tables 1; references 2: 1 Russian, 1 Western.

[38-2415]

*(An exterior view of the contact is shown on the cover of "Elektrosvyaz," No 1, 1979)

TRANSMISSION OF DISCRETE AND ANALOG DATA OVER CABLE LINES OF URBAN TELEPHONE NETWORKS

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 79 pp 26-29 manuscript received 3 Apr 79

LI, E. D., MARIMONT, L. B., NICHAYEVSKIY, L. M. and PARFENOV, YU. A.

[Abstract] Urban telephone and telegraph networks can be utilized for transmission not only of analog but also discrete data. Here the signals of both kinds are compared and the apparatus for adaptation to existing cable lines is characterized. With regard to low-speed, medium-speed, and high-speed transmission of discrete data over telephone cables, recommendations are made concerning the appropriate voltage and attenuation levels, pulse forms, modulation methods, and the degree of circuit symmetry to ensure electromagnetic compatibility and to suppress interference. Standards established by

the International Telegraph and Telephone Consultative Committee and the International Radio Communication Consultative Committee as well as design and operating parameters of the USSR Unified Automatic Telecommunications Network are also brought into the picture. Tables 7; references 2 (Russian). [38-2415]

USSR

UDC 621.396.329

EXTREMAL AUTOMATIC TRACKING SYSTEMS FOR EARTH STATIONS

Moscow ELEKTROSVYAZ' No 8, Aug 79 pp 29-35 manuscript received 22 Dec 78

KUDEYAROV, G. N., FADEYEV, O. F. and TSIRLIN, V. M.

[Abstract] In planning automatic tracking systems for the earth stations of satellite communication networks, proper selection of the algorithm of operation and optimization of the parameters as a function of external perturbation caused by shifting of the extreme point (maximum of signal received) is quite important. The Monte Carlo method was used to calculate the optimal value of the step in a discrete tracking system of this type. A flow chart for the algorithm for search for the extreme is presented and analyzed. A second flow chart is presented, for an algorithm which includes a halt sequence, which is demonstrated to improve tracking in terms of minimum signal strength maintained, in comparison to a continuous search algorithm. The optimal value of the step of operation of the earth station is found to be about 2' at the elevations and signal levels studied. Figures 3; tables 2; references 3: 2 Russian, 1 Western. [19-6508]

BRIEFS

ZHITOMIR AUTOMATIC TELEPHONE STATION--Zhitomir. Several years ago in our microregion they began building an automatic telephone station on Vitruka Street. At first the work proceeded rapidly and it seemed that in 3 or 4 months the building would be completed. But as soon as the builders completed the pouring of the foundation and the tiling of the walls, everything at the site came to a halt. The unfinished building has been standing there for two years. The tiles have been allowed to fall off and the materials that the builders left behind without supervision have been stolen. Moreover the residents of the microregion are still waiting to have telephones installed in their apartments. It is clear that they will have to wait more than a year. Ye. Naduda, driver. (Kiev RABOCHAYA GAZETA in Russian 11 Aug 79 p 2] 8927

UNDELIVERED TELEGRAM RESULTS IN DISCIPLINARY ACTION--Nikolayevskaya Oblast. A. Seleznev from Krivoy Rog wrote to the editors about the fact that a telegram he had sent was not received by the addressee. The chief of the main administration of long distance telephone communications of the UkSSR Ministry of Communications, Ye. Gerchikov, has responded concerning the results of checking into the charge. The fact was confirmed. The guilty parties--telegraph operator N. Kovalenko and brigade chief M. Galushko from the Ochakovskiy communications center--have been disciplined. The money was returned to the sender. [Kiev PRAVDA UKRAINY in Russian 28 Aug 70 p 2] 8927

NEW AUTOMATIC TELEPHONE STATION--Kiev. On Kalinin Street a new automatic telephone station, ATS-28, is being built. When it is put into operation the quality of communications will be significantly improved and the number of telephones in the central part of the city will be increased. The complicated geological relief and the constraints upon the builders (around a complex of housing units that are close to each other) posed a complicated task to the architects of the Kiev designing organization [Kievproyekt]. A two-story administration building will be located in steps on a steep street. A four-story technical unit will be erected next to it. Powerful air conditioners will maintain an optimal microclimate in its working halls and narrow embrasures of the windows will prevent the direct rays of the sun from entering the facility [Kiev PRAVDA UKRAINY in Russian 10 Aug 79 p 4] 8927

NEW AUTOMATIC TELEPHONE STATION IN BELYY KLYUCH--Sakhalin. An automatic telephone station for 50 subscribers has replaced a manual switchboard in the remote lumbering settlement of Belyy Klyuch. This is not the first new automatic telephone station in Sakhalin. A station for 1,000 subscribers was put into operation in Okha; the capacity of the telephone net in the fishing settlement of Pravda was increased 1.5-fold. K. Vyatkov. [Moscow STROITEL'NAYA GAZETA in Russian 5 Sep 79 p 3] 8927

CSO: 1860

USSR

UDC 621.372.8

SYNTHESIS OF FLAT DIELECTRIC WAVEGUIDES WITH A LIMITED NUMBER OF PROPAGATED MODES

Moscow **RADIOTEKHNIKA I ELEKTRONIKA** in Russian Vol 24 No 8, 1979 pp 1507-1517 manuscript received 10 May 78

ANDRUSHKO, L. M., LITVINENKO, O. N. [deceased], NAUMENKO, K. P. and SHCHEPKINA, YE. D.

[Abstract] A method for the synthesis of flat dielectric waveguides with a limited number of modes is proposed. The synthesis is based on a fixed constant of mode propagation according to the spectrum of mode frequencies and the curvature of dispersion characteristics at these frequencies. If a propagation constant equal to the propagation constant of a plane wave in the material of the substrate is selected, the source data for the synthesis will be the cutoff frequencies and the curvature of dispersion characteristics at these frequencies. This method allows a precise reconstruction of the pattern of variation in permittivity over the cross sectional area of the waveguide, and in the characteristics of lower-order modes. It is shown that with increase in the number of modes with changed cutoff frequencies the analytic solution of the presented integral equation becomes increasingly more difficult. Figures 5; tables 1; references 9: 7 Russian, 2 Western. [22-1386]

USSR

UDC 537.876.4

SOLUTION OF THE PROBLEM OF NATURAL WAVES BY THE MINIMAL AUTONOMOUS ELEMENT METHOD

Moscow **RADIOTEKHNIKA I ELEKTRONIKA** in Russian Vol 24 No 8, 1979 pp 1518-1527 manuscript received 5 Jun 78

NIKOL'SKIY, V. V. and LAVROVA, T. I.

[Abstract] The new decomposition method termed by the authors the minimal autonomous element (MAB) method was originally applied to waveguide diffraction problems--in particular, to diffraction on gyrotropic elements, and now it is applied to analysis of natural waves. In this connection, a technique for the algorithmization of the pertinent boundary-value problems is proposed. One approach presented is that of reducing the natural wave problem to the algebraic eigenvalue problem. The expediency of using gyrotropic MAB methods

is demonstrated. The MAB technique is applied to the solution of problems of: transcritical losses in a rectangular waveguide; a rectangular waveguide with a dielectric core; strip lines on a ferrite substrate for three different types of magnetization; and a periodic strip structure on a ferrite substrate. It is shown that the MAB method can be used to construct the mathematical models of various electromagnetic wave guiding systems, even though for the time being its applicability is limited to the class of isotropic objects. All the calculation data presented was obtained on the "BESM-6" computer (FORTRAN language). Figures 10; references 7: 5 Russian, 2 Western.
[22-1386]

USSR

UDC 621.372.8

CHANGE IN THE SIGN OF NONRECIPROCITY FOR WAVE ATTENUATION IN A SEMICONDUCTOR-CONTAINING WAVEGUIDE

Leningrad ZHURNAL TEKHNICHESKOY FIZIKI in Russian Vol 24 No 8, 1979 pp 1677-1680 manuscript received 11 Jan 78

USANOV, D. A., KOROVIN, V. N., SHISHKIN, G. G., VAGARIN, A. YU. and FEKLISTOV, V. B.

[Abstract] In a semiconductor-containing waveguide, the attenuation of the microwave may be characterized by a marked nonreciprocity caused by displacement of the transverse magnetic field in which the semiconductor is placed. This nonreciprocity may be of an explicitly extremal nature with respect to both semiconductor temperature and magnetic field intensity, and it changes in sign with a change in the semiconductor temperature or magnetic field intensity, so that it cannot be adequately explained by the field displacement criterion associated with the orientation of the $\mathbf{P} \times \mathbf{B}$ vector, where \mathbf{P} is the Poynting vector and \mathbf{B} is the induction vector of the external magnetic field. Hence a more detailed experimental analysis of nonreciprocal wave propagation in a waveguide partially filled with a transversely "magnetized" n-InSb semiconductor is now presented. It is shown that the direction of displacement of the microwave field may get reversed depending on the values of the electrophysical parameters of the semiconductor and the magnitude of the external magnetic field with a fixed orientation. Figures 2; references 10: 4 Russian, 6 Western.
[22-1386]

EFFECT OF HIGHER-ORDER WAVE TYPES ON WAVE ATTENUATION IN A SEMICONDUCTOR-CONTAINING WAVEGUIDE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24 No 8, 1979 pp 1681-1683 manuscript received 23 Jan 78

USANOV, D. A., FEKLISTOV, V. B. and VAGARIN, A. YU.

[Abstract] The position and geometry of semiconductors in waveguides were investigated in relation to their effect on wave decay. The experiments were conducted with plane-parallel n-type InSb semiconductor specimens having the room-temperature electron concentration $n = 2.6 \cdot 10^{16} \text{ cm}^{-3}$ and the mobility $\mu = 66,000 \text{ cm}^2/\text{v-sec}$. Measurements of wave decay as a function of the position of the semiconductor in the waveguide were performed at room temperature within the 8-mm wavelength range (waveguide cross sectional area, $0.72 \times 0.36 \text{ cm}^2$). The measurements revealed the existence of two distinct wave-decay maxima in the presence of a gap between the semiconductor and the broad wall of the waveguide, depending on the distance between the semiconductor and the narrow wall of the waveguide. This pattern of wave decay depending on the position of the semiconductor is associated with the formation of higher-order wave types, and primarily of the H_{20} wave. This pattern can be counteracted by using a waveguide partially filled with a transversely magnetized n-type silicon semiconductor. These considerations should be taken into account in the design of microwave semiconductor devices. Figures 5; references 9: 7 Russian, 2 Western. [22-1386]

NUMERICAL INVESTIGATION OF THE PROPAGATION CONSTANTS OF SYMMETRICAL MAGNETIC WAVES IN A CIRCULAR CORRUGATED WAVEGUIDE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24 No 8, 1979 pp 1684-1685 manuscript received 31 Jan 78

AL'KHOVSKIY, E. A. and IL'INSKIY, A. S.

[Abstract] A previously developed algorithm for the determination of dispersion and attenuation characteristics of nonsymmetrical waves is now applied to the determination of these characteristics for symmetrical magnetic waves in a circular corrugated waveguide with a sinusoidal form of corrugation which are represented by a Fourier-series expansion, the function describing the shape of the corrugations. Dispersion characteristics of the

H_{01} , H_{02} , H_{03} , H_{04} , and H_{05} waves and attenuation characteristics of the H_{01} wave are correspondingly computed. The numerical calculations apply to the lower pass bands, but this does not impose any constraints on the algorithm. Figures 2; references 5 (Russian).
[22-1386]

USSR

UDC 537.8.76.4

CALCULATION OF THE DISPERSION CHARACTERISTICS OF A HELIX SURROUNDED BY A DIELECTRIC PIPE AND A LONGITUDINALLY RIBBED SCREEN

Moscow RADIOTEKHNICA I ELEKTRONIKA in Russian Vol 24 No 8, 1978 pp 1673-1677 manuscript received 23 Jan 78

LOSHAKOV, L. N. and LYSAK, A. YU.

[Abstract] There exist known working formulas for the analysis of the dispersion properties of a quasi-symmetric slow wave in a line consisting of a helix located within a longitudinally ribbed metal screen with a dielectric pipe present between the helix and the screen's ribs. In the present paper these formulas are extended to the case of the presence of an additional vacuum region between an anisotropically conducting helical surface and the enclosing dielectric pipe. An approximate solution of the pertinent dispersion relation is presented. It is concluded that the dispersion characteristics of the line can be best controlled by aligning the ribs of the screen at the intervals between the dielectric supports of the helix. The addition of a vacuum clearance between the tube and the helix reduces wave slow down within a broad range of frequencies. Figures 2; references 2 (Russian).
[22-1386]

USSR

UDC 621.372.8:621.371.334:537.611.44

APPLICATION OF THE MINIMAL AUTONOMOUS ELEMENT METHOD TO PROBLEMS OF DIFFRACTION OF DIELECTRIC AND GYROMAGNETIC CYLINDRICAL RODS IN A WAVEGUIDE (INCLUSIVE OF THE FERROMAGNETIC RESONANCE CASE)

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24 No 8, 1979 pp 1528-1532 manuscript received 11 Sep 78

NIKOL'SKIY, V. V. and LAVROVA, T. I.

[Abstract] The minimal autonomous element (MAE) method (see Radiotekhnika i Elektronika, Vol 24 No 8, 1979 pp 1518-1527) is applied here to problems of diffraction on gyromagnetic and dielectric cylindrical rods in a rectangular waveguide, with the difference that the MAE system is now used in the form of parallelepipeds to represent the field in the presence of a curvilinear interface between the media. The applied stepwise approximation of the field has proved to produce satisfactory results. The diffraction of the H_{10} wave of a rectangular waveguide on a dielectric cylinder of comparatively low optical density is considered. Other cases considered include the solution of the problem of the diffraction of the H_{10} wave on a gyromagnetic rod in the region of ferromagnetic resonance as well as in the presence of small magnetizing fields. The modules and phases of elements of the scattering matrix of elements of the lengthwise-magnetized cylinder in the region of ferromagnetic resonance are plotted. Figures 6; tables 1; references 8: 5 Russian, 3 Western.
[22-1386]

USSR

UDC 621.372.832:621.382.2

ANALYSIS OF A FREQUENCY SHIFT MIXER BASED ON A DIODE WITH MANY-VALLEY ELECTRON TRANSFER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24 No 8, 1979 pp 1700-1702 manuscript received 14 Sep 77

GORFINKEL', V. B., KISIN, M. V., MEDVEDEV, V. D. and POSADSKIY, V. N.

[Abstract] A major problem in the design of frequency shift mixers (FSM) is the amplification of the intermediate-frequency signal. One way of solving this problem is to use a diode with many-valley electron transfer (MVET), which displays both nonlinear properties and negative admittance. In this connection, it was of interest to analyze this device with the object of determining the effect of the parameters of the MVET diode on the performance

of the mixer. To this end, the equations describing the MVET diode within the framework of the field model were linearized as the result of simulating a supercritically doped MVET diode with the aid of a BESM-6 computer, and plotting the dependence of elements of the admittance matrix on the heterodyne signal voltage. The method developed makes it possible to investigate the effect of the parameters of the METV diode on the characteristics of the frequency shift mixer, to select the optimal operating mode of the mixer with respect to constant voltage and the voltage of the heterodyne signal, and to evaluate the dynamic range and frequency characteristics. The theoretical findings were in agreement with experiment. Figures 3; references 5: 4 Russian, 1 Western.

[22-1386]

USSR

COORDINATION OF DEVELOPMENT ACTIVITIES PERTAINING TO DIGITAL TELEVISION IN THE SOVIET UNION

Moscow TEKHNKA KINO I TELEVIDENIYA in Russian No 9, Sep 79 pp 76-77

PALITSKIY, V. M. and CHIRKOV, L. YE.

[Abstract] Digital equipment installed at the Belorussian Television and Radio Center for joint transmission of video and audio signals exemplifies developments and new trends in broadcasting techniques. Eventually, fourth-generation digital devices are expected to replace analog devices altogether. A conference on this subject and for the purpose of coordination was held 11-12 April 1979 by the Scientific-Technical Council at the USSR State Committee on Television and Radio Broadcasting with the participation of the All-Union Scientific Research Institute of Television, the All-Union Scientific Research Institute of Television and Radio Broadcasting, the All-Union Correspondence Electrotechnical Institute of Communication, the Scientific Research Institute of Radio, and the All-Union Scientific Research Institute of Radio Receiver Apparatus. The representatives of these organizations, experts in the field, reported on their work and achievements. In the ensuing discussion were pinpointed major projects deserving further foremost attention. These include development of a digital videomagnetophone, increasing the transmission capacity of digital communication channels, new methods of and equipment for decoding SECAM signals with maximum fidelity, and development of a solid-state digital television camera.

[37-2415]

USSR

UDC 681.325.5 + 681.327.21

COMBINED NANOSECOND ANALOG-DIGITAL CONVERTER

Moscow PRIBORU I SISTEMY UPRAVLENIYE in Russian No 8, 1979 pp 18-19

NOVITSKIY, A. P., engineer

[Abstract] At present direct-reading analog-digital converters (ATsP) and series-parallel ATsP are widely used for analog-digital conversion of rapidly changing signals with high quantization. The first assures maximum frequency quantization of the signal. However, for a k -digit converter $2^k - 1$ comparators are required. Converters of the second type are more economical with respect to equipment but in them the origin the error of readout ambiguity is possible. In order to decrease this error it is advisable to use a conveyer ATsP with employment of an algorithm "with a series increase of remainders." This type of ATsP consists of series connected stages, each of which has an analog input and analog and digital outputs. A circuit based on a previous work by the author (Novitskiy, A. P., "Nanosecond analog-digital converters with output in Gray code," Pribory i tekhnika experimenta, 1978, No 3) is presented, on the basis of which a semidigital ATsP is constructed with a maximum time of propagation of the signal of 200 nanosec and input range from -1 to -3 V which has an output code $a_1 \dots a_7$. In order to investigate the dynamics of the ATsP a recording was made of test signals -- rectangular pulses with fronts of approximately 40 nanosec or a sinusoid. The investigation established that the combined semidigital ATsP which was developed has a dynamic component of error, the average quadratic value of which is monotonically magnified with growth of the rate of change of the input signal but does not exceed units of the lowest order with the rate of the input signal up to 2 V/microsec. Figures 2; references 2 (Russian). [7-6415]

USSR

UDC 681.325.(088.8)

NEW METHODS OF CONSTRUCTION OF QUICK ACTING ANALOG-DIGITAL CONVERTERS

Moscow PRIBORU I SISTEMY UPRAVLENIYE in Russian No 8, 1979 pp 15-17

S.FRONOV, V. P., candidate in technical sciences

[Abstract] An analysis is made of known methods and devices for quick-acting analog-digital converters, which make it possible to establish some general regularities and procedures of the organization of the processes of conversion, the essentials of which are parallelism--the method of realization of operations in the form of a series of independent and simultaneously passing

microoperations, matched in the time of the processes and operation, storage (fixation) of instantaneous values of analog and discrete magnitudes, adaptiveness of the conversion process, correction of errors and others. One of the ways of reducing the number of threshold devices (PU) needed is the use of electronic analog devices with conversion functions $U_{out} = f(U_{in})$ in the form of a multiple broken line. The author proposes algorithms of the operation and structural scheme of an analog-digital converter where the parallel principle of folding (svertki) of an analog signal with a subsequent storage of analog and discrete magnitudes is used. The means of construction of quick acting analog-digital converters considered make it possible to improve the dynamic precision, to expand the functional possibilities, to create the most optimum agreement of the analog-digital converter characteristics with the parameters of the signals in question, and to increase the technological effectiveness of devices at the planning stage. Figures 11; references 9: 5 Russian, 4 Western.
[8-6415]

USSR

UDC 621.325(088.8)

DESIGNING OF FOLLOW-UP ANALOG-DIGITAL CONVERTERS

Moscow PRIBORU I SISTEMY UPRAVLENIYE in Russian No 8, 1979 pp 17-18

SHEVCHENKO, V. P., engineer, SAFRONOV, V. P., candidate in technical sciences, and SHLYANDIN, V. M., dr in technical sciences

[Abstract] The paper discusses two modifications of a follow-up analog-digital converter (SATsP) which were developed in the Industrial Scientific-Research Laboratory of the Penzensk Polytechnical Institute. The converters had the following characteristics

	SATsP-1	SATsP-2
Number of binary digits	11	10
Range of change of input signal (volts)	± 2	± 1
Frequency of distribution of codes, in MHz, in mode		
Follow-up	2.5	4
Multichannel	0.5	0.8

Figures 2; references 3: 2 Russian, 1 Western.
[7-6415]

USSR

UDC 537.312.62:621.3.029.6

PROPERTIES OF EXTERNALLY PUMPED JOSEPHSON JUNCTIONS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24 No 8, 1979 pp 1630-1639 manuscript received 13 Sep 78

ZAVALEYEV, V. P. and LIKHAREV, K. K.

[Abstract] The nonlinear qualities of Josephson junctions make them valuable components of microwave receivers. But while the junctions operating in the self-pumped mode have been extensively investigated, little is known about the externally pumped junctions. In this connection, a method for computing the noise and signal characteristics of the externally pumped Josephson junction in the presence of intense monochromatic signals is proposed. The method is based on the assumption of smallness of the fluctuations, as then the processes in the externally pumped junction can be described within the framework of the Likharev-Ul'trikh resistance model. In particular, it is used to compute parameters decisive to the performance of a stepdown frequency converter (mixer): differential resistance of the junction, static conversion factor, and spectral density of low-frequency voltage fluctuations. Figures 1; references 8: 3 Russian, 5 Western.
[22-1386]

USSR

UDC 681.787.7:537.312.62

ANALYSIS OF OPERATION OF SUPERCONDUCTING QUANTUM INTERFEROMETERS IN THE HYSTERESIS MODE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24 No 8, 1979 pp 1640-1648 manuscript received 21 Sep 78

LIKHAREV, K. K., SNIGIREV, O. V. and TINCHEV, S. S.

[Abstract] Single-contact superconducting quantum interferometers [SKvid] operating in the hysteresis mode are widely used in low-temperature experiments. In this connection, the processes occurring in hysteresis-mode SQI in the presence of various values of the high-frequency response plateau and the mismatch between the pumping frequency ω and the natural frequency of the circuit are investigated for $l \gg 1$. The calculations are based on a simple analytic method using the parallelogram model, and it is shown that in the presence of high plateau numbers allowance must be made not only for the dissipative but also for the reactive component of the first harmonic of the flux in the interferometer. In particular, there exists a definite

range of frequency mismatch values and plateau numbers within which a triangular signal response curve can be obtained. The experiments conducted were found to be in agreement with these conclusions. The proposed method is extremely promising for the analysis of superconducting quantum devices with more complex oscillatory systems whose large number of parameters renders less useful the conduct of computer-assisted exact calculations. Figures 5; references 7: 2 Russian, 5 Western.
[22-1386]

USSR

UDC [621.313.32:538.311].001.24

ON DAMPING OF THE SLOT LEAKAGE FLUX IN THE STATOR WINDING OF SURGE GENERATORS

Moscow ELEKTRICHESTVO in Russian No 8, Aug 79 pp 71-73 manuscript received 5 Oct 77

BAKLIN, V. S., KUTAREV, A. M., SIPAYLOV, G. A., KHOR'KOVA, V. Z. and KHOR'KOV, K. A., Tomsk Polytechnical Institute

[Abstract] One of the means of increasing the power of surge generators is the reduction in every possible way of the inductance of the stator winding. In the present paper the slot leakage flux of a single-layer single-phase stator winding of a surge generator is damped by current-conducting screens, located in special slots stamped in the teeth of the stator. With the presence of current-conducting screens in the teeth of the stator, the pattern of the electromagnetic field in the limits of the phase zone is periodically repeated at each tooth division which gives the possibility of limiting investigations of the electromagnetic field at the tooth of a division of the stator. Calculation of the electromagnetic field was conducted by the method of finite differences with a two-dimensional statement of the problem in a cartesian system of coordinates with use of a complex vector potential. It is established that during screening of the slot leakage flux, it is advisable to increase the height of the stator slot. With constant values of the circuit in the slots the thermal load of the stator winding is diminished. Figures 5; references 5: 3 Russian, 2 Western.
[9-6415]

USSR

UDC 621.313.045.001.2

CALCULATING A PULSE VOLTAGE SPIRAL GENERATOR

Moscow FLEKTRICHESTVO in Russian No 8, Aug 79 pp 8-13 manuscript received 19 Mar 79

ZHELTOV, K. H., candidate in technical sciences (Moscow)

[Abstract] A spiral generator of pulse voltage is described, a compact device which makes it possible to charge a capacitive load up to hundreds of kilovolts and above. A method is presented for calculating such a generator, operating both in an idling regime and with a capacitive load. The basis of the generator is equivalent circuits in the form of two spiral strip lines and in essence it is a capacitor with a pair of plates which have been short-circuited by a low inductance discharger with respect to the input, e.g.,

from one edge of the plate. The strip lines are replaced in the present paper by oscillatory circuits with a half period equal to double the electrical length of the lines. As a result the equivalent circuits are changed to a form convenient for determination of the typical frequencies of the generator. Figures 6; references 4: 2 Russian, 2 Western.
[9-6415]

USSR

UDC 621.313.045.001.2

EVALUATING THE QUALITY OF MULTI-SPEED WINDINGS OF ELECTRIC MOTORS

Moscow ELEKTRICHESTVO in Russian No 8, Aug 79 pp 31-35 manuscript received 1 Feb 79

DARTAU, A. A., candidate in technical sciences. VNIIElektromash (All-Union Scientific-Research Institute of Electrical Machine Building)

[Abstract] Criteria for the quality of multi-speed windings of electric motors are proposed, and a method of comparative calculations of these criteria is cited. The results are presented of calculations by this method for 14 presently known versions of the design of two-speed windings, exchangeable from 8 to 6 poles. Six of the versions are designed according to the method of pole-amplitude modulation and are characterized by alternation of coil groups in phases. Four versions were proposed by T. G. Soroker and V. Kh. Nutov. The remaining four versions are designed according to the author's method (Elektrichestvo, 1979, No 6) and are characterized by the number of coils in the coil group and the number of arms in the stars of the magnetomotive force of the coil groups. It is shown that windings with small values of differential scattering are preferable with respect to the criteria proposed. Figures 1; tables 1; references 10: 8 Russian, 2 Western.
[9-6415]

USSR

UDC 621.313.322.017.71.001.5

SOME PROBLEMS IN DIAGNOSING THE THERMAL STATE OF ELECTRICAL MACHINES

Moscow ELEKTRICHESTVO in Russian No 10, Oct 79 pp 20-26 manuscript received 22 Nov 78

GUREVICH, E. I., candidate in technical sciences and MAMIKONYANTS, L. G., doctor in technical sciences

[Abstract] A problem arises in diagnosing the thermal state of electrical machines in order to evaluate the cooling requirements or a performance analysis of the cooling system because not all points of likely thermal defectiveness can be covered with temperature probes. One can solve this problem reasonably well by performing extra tests under special conditions such as transient ones where mean readings are just as informative as local readings, by making indirect measurements, and by expedient data processing. Here this approach is applied to a typical case of a water turbine generator. All possible thermal defects are classified and characterized first of all, whereupon a diagnostic experiment is set up including spot checks and subsequent verification. The results are correlated with the theoretical temperature distribution so that the true cause of a hot spot can be established among several hypothetical ones. The thermal characteristics of the machine structure are taken into consideration as, for instance, in the case of d.c. field coils. Figures 8; references 10 (Russian).

[36-2415]

USSR

UDC 621.316.066.6.001.5

PROBLEMS OF CONTACTS IN THE DESIGN OF ELECTRICAL POWER APPARATUS

Moscow ELEKTRICHESTVO in Russian No 10, Oct 79 pp 39-44 manuscript received 21 Sep 78

BRON, O. B., doctor in technical sciences, Leningrad

[Abstract] In the design of electrical power apparatus it is still not feasible completely to convert to contactless devices, but making contactive devices competitive requires new solutions to the classical problems. Foremost among these problems is silver and copper economy. Copper economy depends on a sufficiently high contact pressure which will inhibit oxidation and thus allow higher operating temperatures. Silver economy depends on the most efficient utilization of this precious metal in both active contact

elements and solder for electrical connections, on optimization of silver coating, on adequate cooling to reduce evaporation, and on possible replacement of silver with equally erosion resistant metals. Wear is the major cause of loss of metal, new trends in the field of contact development include liquid-metal and arcless switches. At the same time, extensive research is underway concerning superconductivity and contact performance at cryogenic temperatures as well as plasma behavior and arc quenching the inclusion of gas dynamic processes. The present paper is an abridgement of a report at the All-Union Conference on the Quality and Reliability of Electrical Contacts, Leningrad 28-30 March 1978. Figures 4; references 12: 7 Russian, 5 Western.
[36-2415]

USSR

UDC 621.316.543.019.3:621.314.21

RELIABILITY ANALYSIS OF A THYRISTOR POWER PACK FOR TRANSFORMER SWITCHING

Moscow ELEKTRICHESTVO in Russian No 10, Oct 79 pp 67-68 manuscript received 14 Feb 79

AFANAS'YEV, A. I., DMITRENKO, A. I. and PIROZHENKO, A. N.

[Abstract] A thyristor power pack with protection and controls has been developed, for transformer switching, at the All-Union Institute of Transformer Design. The basic device consists of 12 thyristors, 3 in series per branch, in either a parallel-series or a series-parallel configuration. In the latter case there is a modification available with a fourth thyristor in series added in each parallel branch and the total number of thyristors thus increased to 16. The number and the performance class of the thyristors were selected on the basis of their rating and of the voltage per transformer regulation step. Here the reliability of both configurations is analyzed on the basis of the appropriate differential probability equations, assuming a Weibull distribution of failure-free switching events. The results indicate that the less costly parallel-series configuration with a life expectancy of 10^5 cycles is preferable for general-purpose transformers designed to operate with a low switching frequency, while the more costly series-parallel versions with a life expectancy of 10^6 cycles are preferable for special-purpose (electric furnace) transformers designed to operate with a high switching frequency. Figures 1; tables 1; references 6: 5 Russian, 1 Western (in translation).
[36-2415]

USSR

UDC 621.3.013.1.018.756:621.315.554.001.2

DIFFUSION OF PULSED MAGNETIC FIELD THROUGH A SCREEN LOCATED IN THE VICINITY
OF A MASSIVE FERROMAGNETIC BODY

Moscow ENERGETIKA I TRANSPORT in Russian No 3, May/Jun 79 pp 87-93 manuscript
received 12 Jan 78

PIS'MENNY, E. I. (Kharkov)

[Abstract] The problem of penetration of a pulsed magnetic field through a screen located in the vicinity of a massive nonferromagnetic body is considered in a previous work by V. M. Mikhaylov and E. K. Pis'mennyy (Energetika i transport, 1974, No 6). However, in practice the need arises to consider the screening action of plates and shells in the presence of massive ferromagnetics. (Such systems are widely used in magnetic-pulse technology, as well as during construction of bimetallic solenoids, the base of which is made of ferromagnetic material.) The present work is concerned with an analysis of the diffusion of the electromagnetic field in similar systems. The investigation is conducted by numerical methods with use of the general purpose magnetization curve. It is concluded that penetration of a pulsed magnetic field into a ferromagnetic plate, a bimetallic conductor with a ferromagnetic base and a screen located in the vicinity of a massive ferromagnetic body, depends on the magnitude of the amplitude of the intensity of the external magnetic field of the plate, covering or screen and the ratio of the electrical conductivity of the covering (screen) and the half-space. Figures 4; references 9: 8 Russian, 1 Western.
[21-6415]

USSR

UDC 537.8

SPECTRUM SEPARATION METHOD IN THE PROBLEM OF THE TWO-DIMENSIONAL MOTION OF
CHARGED PARTICLES IN A STRONG MAGNETIC FIELD

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24 No 8, 1979 pp 1599-1607 manuscript received 28 Dec 78

VAKMAN, D. YE. and VAYNSHTEYN, L. A.

[Abstract] The classical problem of two-dimensional motion of a charged particle in an inhomogeneous electrostatic field in the presence of a strong homogeneous magnetostatic field is analogous to the problem of near-harmonic nonlinear oscillations, and usually it is solved by the averaging method, which, however, serves only to uncover first-order effects. It is now shown that the spectrum separation method, based on considerations of mutual non-intersection of the spectra of orbital-center drift and orbital motion, is

more effective in the sense that it can be used to investigate in greater detail and uncover previously unknown physical effects and in particular to locate the upper orbital motions and to determine drift motion more precisely. References 6 (Russian).

[22-1386]

USSR

UDC 538.574.2

THEORY OF SLOW ELECTROMAGNETIC WAVES IN A CONDUCTING JET

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 22 No 9, Sep 79 pp 1070-1076
manuscript received 13 Jul 78

ZELEKSON, L. A. and STEPANOV, N. S., Gorskiy State University

[Abstract] Slow electromagnetic TE-waves are considered which propagate with a velocity $v(z)$ along the z -axis of a plane jet with an arbitrary velocity profile, with a dielectric permittivity $\epsilon(z)$ and an electrical conductivity $\sigma(z)$. An exact solution is obtained to the "external" problem in both the slower-than-light and the faster-than-light cases, also for a transition layer in both the long-wave and the short-wave approximations. In the "internal" problem, furthermore, a dispersion equation is obtained for natural modes which at the long-wave limit reduce to symmetric and antisymmetric surface waves. A solution of this equation by the perturbation method reveals the instability criteria and the possibility of wave amplification. References 9 (Russian).

[51-2415]

USSR

UDC 621.385.6

TRAJECTORIES OF ELECTRONS IN A MAGNETRON AT CYCLOTRON RESONANCE

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 22 No 9, Sep 79 pp 1131-1143

manuscript received 2 Feb 78

KRASNIKOV, M. YU. and KUZNETSOV, M. I., Gorkiy State University

[Abstract] The motion of electrons in a magnetron at cyclotron resonance is analyzed by the approximate method of averaging. The variation of quantities characterizing the trajectory of an electron is assumed to be small, relative to the inhomogeneity scale, over one cyclotron period. The equations of motion in two crossing constant fields and a high-frequency field are considered, disregarding the relativistic effects and the effects of space charge between plane electrodes. The trajectory parameters are calculated, which include the smallest radius of an electron orbit and the time to reach it as well as the phase corresponding to a unit Larmor radius, in the case of exact synchronism. Furthermore, the conditions of electron entrainment in "spokes" caused by resonant interaction are established and the efficiency of a magnetron at cyclotron resonance is calculated with asynchronism taken into account. The efficiency is found to increase with larger interelectrode distance, reaching 0.3-0.5 at sufficiently large initial orbit radii and with the drift velocity smaller than but in the same direction as the phase velocity. The output power, however, is found to peak at the critical length of the interelectrode distance depending on the magnetron geometry. Figures 4; references 4 (Russian).

[51-2415]

USSR

UDC 537.312.62:621.3.029.6

NONDEGENERATE SINGLE FREQUENCY REGENERATION IN EXTERNALLY PUMPED PARAMETRIC SYSTEMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24 No 8, 1979 pp 1695-1697
manuscript received 10 Aug 77

LIKHAREV, K. K. and RADZIKHOVSKIY, V. N.

[Abstract] The nondegenerate single-frequency parametric regeneration effect (NSPGE) manifests itself, in particular, in that the impedance of a nonlinear reactive element (e.g. a Josephson junction) can have a negative real part at the signal frequency even in the absence of energy exchange with an external system at all other frequencies. It is now shown that NSPGE is also possible in externally pumped parametric elements of any type provided that this effect causes the reactive parameter of the element periodically to assume sufficiently high negative values. This also applies to capacitive elements. The parametric systems utilizing this effect, and particularly nondegenerate single-frequency externally pumped amplifiers can display a number of advantages over their self-pumping counterparts. Chiefly, the width of the pumping line is independent of characteristic impedance of the element and hence the regeneration effect can be amplified with the aid of high-resistivity elements. Moreover, the possibility of selecting the level of the pumping signal will then assure more optimal operating modes of the amplifiers. The Josephson junction is particularly suitable in this case, because its differential inductance can be negative. Figures 2; references 5 (Russian). [22-1386]

USSR

UDC 537.874.6:621.372.029.2

PLANAR ACOUSTOOPTICAL MODULATOR-DEFLECTOR USING THE SPACE HARMONICS OF A TWO-PHASE PIEZOELECTRIC TRANSDUCER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24 No 8, 1979 pp 1697-1699
manuscript received 26 Jul 77

GUDZENKO, A. I., DERYUGIN, L. N., ZABUZOV, S. A., OSADCHEV, L. A., SIROTIN, G. P. and SOTIN, V. YE.

[Abstract] The planar acoustooptical modulator deflector (PAOMD), based on an optical waveguide consisting of a piezoelectric crystal substrate and a polystyrene film is known to perform satisfactorily in the Raman diffraction mode as well as at collinear interaction of optical waveguide waves (OWW)

with acoustic surface waves (ASW) when the frequency of the latter waves is ~ 30 MHz. At higher ASW frequencies such modulators may operate in the Bragg diffraction mode. However, the practical introduction of two-phase exciters for higher ASW frequencies entails marked technological difficulties. It is now shown that these difficulties can be partially surmounted by exciting ASW with the aid of two-phase exciters operating at multiple odd-numbered space harmonics. When such harmonics up to the 19th harmonic are used inclusively effective diffraction of OWW beams of the E- and H-types—qualitatively analogous to Raman diffraction—was observed on traveling ASW with a 28 MHz frequency, as well as on ASW with frequencies of 84 and 140 MHz (analogous to Bragg diffraction). Thus the feasibility of using two-phase exciters at space harmonics in PAOMD is demonstrated. Figures 3; references 3 (Russian).
[22-1386]

USSR

UDC 538.56:519.25

ADAPTIVE COMPENSATION OF NONLINEAR DISTORTIONS

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 22 No 9, Sep 79 pp 1085-1090
manuscript received 26 Oct 78

MAL'TSEV, A. A. and POZUMENTOV, I. YE., Gorkiy State University

[Abstract] The problem under consideration is nonlinear distortions in the input filters of the back channel, and one possible method of their adaptive correction is proposed. It involves the use of an autocompensator with feedback for correcting cubic nonlinearities and, if their power exceeds a critical level, addition of auxiliary compensating channels. The performance of such an adaptive compensation system is evaluated here, in terms of interference suppression level and response time. Figures 2; references 7: 4 Russian, 3 Western.
[51-2415]

ON THE POSSIBILITY OF REDUCING THE FREQUENCY OF FALSE ALARMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24 No 8, 1979 pp 1685-1688 manuscript received 14 Nov 77

BELINSKIY, V. T., GONCHARENKO, O. V., KONSTANTINOVSKIY, A. G., KUDINOV, A. V., STEBLIN, V. F. and CHACHKOVSKIY, S. V.

[Abstract] The noise immunity feature of typical automatic detection circuits should be evaluated as a function not only of the circuit's detection performance but also its mean frequency of false alarms (MFFA). In this connection, the effect is investigated of the order of RC low-frequency filters (LFF) on MFFA, given a fixed probability of false alarms (PFA). It is shown that replacing a single section RC-LFF with its twin-section counterpart which has the same energy band and the same PFA results in reducing the MFFA by approximately 50 percent. This gain diminishes, however, with any further increase in the number of filter sections, as then it asymptotically tends toward zero. The theoretical findings were corroborated by experiments correct to 5 percent. Figures 1; references 2 (Russian).
[22-1386]

USSR

UDC 621.317

TIME OF ESTABLISHMENT OF OSCILLATIONS IN DIGITAL FREQUENCY SYNTHESIZERS

Moscow ELEKTROSVYAZ No 8, Aug 79 pp 50-53 manuscript received 14 Mar 77

GUBERNATOROV, O. I.

[Abstract] A mathematical description of a digital frequency synthesizer is presented and used to develop the general regularities of the process of frequency tuning and phase matching following a mismatch of the frequency signals at the output of a phase detector. The transient process in a digital frequency synthesizer with an integrating filter are analyzed. Equations are produced which can be used for practical calculation of the time of stabilization of the frequency of oscillations at the output of single-loop digital frequency synthesizers with integrating and proportional-integrating filters. Figures 3; references 4: 3 Russian, 1 Western.

[19-6508]

USSR

UDC 631.317

A METHOD OF PROTECTING OF AUTOMATIC TESTING AND DIAGNOSIS APPARATUS AND A LOGICAL UNIT BEING TESTED FROM CURRENT OVERLOADS

Riga AVTOMATIKA I VYCHISLITEL'NAYA TEKHNIKA No 5, Sep/Oct 79 pp 66-69
manuscript received 21 Jun 78 (27 Nov 78)

BELOGUB, V. V. and PRIKHOD'KO, V. I.

[Abstract] A method of protection of automatic testing and diagnosis equipment and the equipment being tested from current overloads in case of short circuits at the interface is suggested, based on indirect measurement of the output current in the channels of the testing and diagnosis equipment. The operation of a test device utilizing this system is analyzed, by means of examination of a block diagram of the apparatus. The method allows reliable protection of the output elements of the testing and diagnosis equipment and the outputs of the equipment being tested from current overloads in case of accidental misconnection, while requiring little additional hardware--a single current sensor for the group of output elements and a pulse-parameter-to-code converter. Figures 3; references 4 (Russian).

[20-6508]

POTENTIOMETRIC DISCRETE PHASE SHIFTER

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 8, 1979 pp 51-52

PYATIN, S. I.

[Abstract] A functional diagram is presented of a potentiometric discrete phase shifter, the special feature of which is the dependence of the shift of each step on the change of any of the resistors of the potentiometer arm. Consequently, adjustment of the value of the phase shift of any step by trial and error is inadmissible because this inevitably leads to a change of the phase shift of all the remaining steps. The phase shifter described is suitable for phase measuring equipment where the phase shift between voltages is measured by the displacement of the point of passage of the instantaneous values of the voltage through zero, i.e., the most widely used at present and promising trigger measurers of phase difference. On the basis of the circuits, devices were developed for shift of the scale for the pointed and oscillographic units of the FK2-14 measurer which made it possible to obtain an error on the order of $0.3--0.5^\circ$ at a frequency of 278 Hz and less than 1° at frequencies up to 1 MHz. The circuit considered can be used for construction of a continuous phase shifter with a linear dependence of the phase shift on the deflection angle, for which it is necessary to use a circular linear potentiometer. Figures 2; references 2 (Russian). [8-6415]

METHODS OF COMPARISON OF PHASE SIGNALS REPRODUCED AT DIFFERENT FREQUENCIES

Riga AVTOMATIKA I VYCHISLITEL'NAYA TEKHNIKA No 5, Sep/Oct 79 pp 62-65 manuscript received 25 Jul 78 (13 Dec 78)

KRAVCHENKO, S. A.

[Abstract] A study is made of methods of comparison of the phase angles of signals at different frequencies. The principles of phase comparison must be based on transformation of the input functionals of the signals to other quantities, in order to eliminate the frequency dependence. A classification system is presented for methods of comparison of signal phase angles. Several types of instruments are described which can generate phase measurements with accuracies of a fraction of a degree from the infralow frequency

band (0.001 Hz) through the microwave (10^{12} Hz) band (though no single instrument covers this entire range), generating standard information which can be used for comparison purposes. Figures 2; references 7: 6 Russian, 1 Western.

[20-6508]

USSR

UDC 621.3.049

DEVELOPMENT OF THICK-FILM HYBRID INTEGRATED CIRCUIT PACKAGES

Moscow PRIBORU I SISTEMY UPRAVLENIYE in Russian No 8, 1979 pp 37-38

ISAYEV, YU. V., candidate in technical sciences, KUZNETSOV, V. S. and
YAKOVLEV, YA. A., engineers

[Abstract] The paper discusses package development (korpuserovaniye), the last and most important stage of the technological process of production of integrated circuits, where it is clearly the aspiration of developers to decrease rejects at this point. The special features of package development for thick film hybrid integrated circuits are shown, and the principal types of packages (korpus) used are evaluated. A photograph is shown of a hollow metal-polymer package for hermetic sealing of a circuit, assembled on a 48 x 60 mm plate. This hollow metal-polymer package can be used in equipment together with plastic and small-scale metal-polymer packages. Use of the packages which make it possible to develop hybrid integrated circuits using large-scale substrates broadens the possibilities of thick-film technology. Figures 1; references 2 (Russian).

[7-6415]

USSR

UDC 538.56:519.25

NONLINEAR NONSTATIONARY THEORY OF DIFFRACTION RADIATION GENERATORS

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 22 No 9, Sep 79 pp 1117-1123
manuscript received 31 Jul 78

BAKAY, A. S., LUKIN, K. A. and SHESTOPALOV, V. P., Institute of Radiophysics and Electronics, Academy of Sciences of the Ukrainian SSR

[Abstract] A nonlinear nonstationary theory of diffraction radiation generators is developed as a basis for numerical simulation of their transient and steady operating modes. A generator is considered which has an open resonator cavity between a spherical mirror and a plane mirror with a reflecting diffraction grating. A self-consistent system of integro differential equations describing the buildup of the oscillation amplitude and the dynamics of motion of particles in an electron beam is formulated for a numerical solution, assuming an energy exchange in the interaction zone between an electron beam and a wave whose amplitude varies slowly during the electron transit time. A solution obtained by the method of large particles, in the one-particle approximation, yields the trajectories with nonlinearities such as hysteresis and cutoff taken into account. The accuracy of that approximation, depending on the initial conditions, and the efficiency of such a generator are estimated relative to a rigorous solution for a multiparticle model with a uniform field distribution. Figures 2; references 20: 19 Russian, 1 Western.

[51-2415]

USSR

UDC 621.395.44

A PSEUDORANDOM PULSE SEQUENCE GENERATOR OPERATING AT 140 Mbit/s

Moscow ELEKTROSVYAZ' No 8, Aug 79 pp 58-60 manuscript received 27 Oct 77

KURILOV, A. V.

[Abstract] A structural diagram is presented of a pseudorandom sequence generator, a shift register with a modulo 2 adder in the feedback loop. The signals at the output of the adder are taken from the outputs of several positions of the register, in accordance with the coefficients of an irreducible binomial. Under the influence of the cycle pulses, the register sequentially shifts through all possible states except the zero state. Thus, an n-digit register forms a M-sequence with a length of $2^n - 1$ bits.

Output signals can be taken from any digit in the register. Use of microcircuits with sufficient operating speeds can yield sequences of up to 120 MHz, while the production of sequences of up to 140 Mbit/s requires the use of special circuits. Combination of several such low-speed pseudorandom sequence generators with alternate interrogation of all digits of the register during each cycle can yield a very high-speed pseudorandom sequence of bits. Figures 4; references 6: 4 Russian, 2 Western.
[19-6508]

USSR

UDC 621.383.52

AVALANCHE PHOTODIODE AS A PULSED RADIATION RECORDER

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24 No 8, 1979 pp 1649-1659
manuscript received 20 Feb 78

TRISHENKOV, M. A.

[Abstract] The optimal operating mode of an avalanche photodiode (AP) pulsed radiation receiver should be so selected that the threshold of the entire device (photoreceiver in tandem with avalanche multiplier would be minimal. The threshold is here construed as the amplitude of the pulse of the radiation for which the photosignal (amplitude) equals noise (dispersion). In this connection, the signal/noise ratio and the magnitude of optimal and quasi-optimal multiplication are analyzed with respect to an AP receiving a bell-shaped luminous pulse with allowance for the high-frequency noise of the amplifier for cases of optimal and quasi-optimal filters. Formulas for the optimal multiplication factor and AP threshold are derived. It is shown that the replacement of a regular photodiode with an AP produces a substantial gain in threshold only in the case of noisy amplifiers and in the presence of optimal filtration. Hence, choosing between a regular photodiode and an AP has to be tailored to the requirements of every individual system. Figures 3; references 14: 8 Russian, 6 Western.
[22-1386]

USSR

UDC 621.311.16.001.24

OPTIMIZATION OF DEVELOPMENT OF AN ELECTRICAL NETWORK ON THE BASIS OF THE METHOD OF BRANCHES AND BOUNDARIES

Moscow ENERGETIKA I TRANSPORT in Russian No 3, May/Jun 79 pp 6-12 manuscript received 8 Feb 78

LAZEBNIK, A. I. and TSALLAGOVA, O. N., Moscow

[Abstract] A model designed as the first stage of long-range planning for the development of the electrical networks of united electric power systems boils down to the solution of a complex nonlinear problem of mathematical programming with discrete and continuous variables. In a previous work by the authors (Energetika i transport, 1974, No 6) it is shown that such a problem can be formulated in the form of a continuous problem of mathematical programming and solved on the basis of the method of branches and boundaries. The model described in this previous work takes into account a number of factors which produces a substantial effect on the configuration of the network. The present work discusses a further development of this previous model, on the basis of the method of branches and boundaries, which also makes it possible to take into consideration additional important factors that have an effect on the network. Figures 4; references 7 (Russian). [21-6415]

USSR

UDC 621.373.42:621.374.383

SYNTHESIS OF FREQUENCIES ON THE BASIS OF FORMATION OF QUASI-MEANDERS

Moscow ELEKTROSVYAZ' No 8, Aug 79 pp 54-57 manuscript received 17 Jul 78

L'VOVICH, A. A. and LEGOTIN, N. N.

[Abstract] The task set in this article is to select from among the $2P$ possible positions of the leading edges of an initial pulse sequence those $2q$ positions which optimize its configuration for the generation of the useful harmonic frequency component $f_q = f_p(q/P)$. The values of the standardized amplitudes of the useful component in quasimeanders satisfy the condition $2/\pi < A_q < 1$, the effectiveness of transformation increasing smoothly with the increase in the ratio P/q . Quasi-meanders are significantly better than earlier types of pulse sequences, because their spectra do not have the most dangerous side product with frequency $f_q(1 \pm (1/q))$ and are better than Walsh functions in terms of protection from side products with dangerous frequencies. Figures 5; tables 1; references 3: 2 Russian, 1 Western.

[19-6508]

USSR

UDC 621.373.826

LASER EFFECT IN AN ACTIVE LONGITUDINALLY INHOMOGENEOUS MEDIUM OF A SPECIAL FORM IN THE ABSENCE OF A MIRROR RESONATOR

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24 No 8, 1979 pp 1587-1593
manuscript received 26 Jun 78

KHAPALYUK, A. P. and KALOSHA, V. P.

[Abstract] The laser effect in active media whose optical properties vary periodically in the longitudinal z -coordinate hinges on the presence of a sufficient feedback that can arise only owing to gradients of properties of the medium in the absence of a mirror resonator. In particular, the identification and investigation of new longitudinally inhomogeneous active media displaying this property is of interest to elucidating the generative mechanism of cosmic masers. In this connection, the laser effect is investigated in a monotonically inhomogeneous layer of an active medium whose permittivity distribution along the longitudinal axis is described by a hypergeometric cosine. It is shown that in such a system the feedback is fairly weak and the most favorable conditions for the occurrence of the laser effect exist in the long wave portion of the spectrum. The resonance system thus arising differs from conventional laser models: a comparatively small active-medium sector lacking any defined boundaries exists within the absorbing medium and can be regarded as a localized source of electromagnetic energy. If laser-effect conditions are not satisfied for that active sector, the pattern of its de-excitation is analogous to thermal (noncoherent) de-excitation of the medium. These findings point to the possible existence of a fundamentally different de-excitation mechanism. In the region of the active sector a resonance may arise and its de-excitation will be accompanied by a more or less intense burst of coherent (nonthermal) radiation. Figures 2; references 12: 8 Russian, 4 Western.

[22-1386]

ADJUSTABLE SUBMILLIMETER RADIATION ATTENUATOR BASED ON VO₂ FILMS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24 No 8, 1979 pp 1670-1672 manuscript received 26 Dec 77

BILENKO, DI. I., ZHARKOVA, E. A., RYABOVA, L. A., SERBINOV, I. A., URINSON, A. S., KHASINA, YE. I. and YUNDEV, D. N.

[Abstract] The advances in lasers operating in the far-infrared and sub-millimeter (SMM) wavelength ranges necessitate the development of various SMMS-radiation attenuators. In this connection, the utilization of the metal-semiconductor phase transition (FPMP) in vanadium dioxide films is of major interest. Accordingly, the optical properties of VO₂ at the 337 micrometer wavelength and the parameters of an adjustable attenuator based on FPMP in vanadium dioxide were investigated on 0.3-0.5 micrometer thick VO₂ film deposited via a sublayer of Fe₂O₃ (200 Å) on a 7-10 micrometer thick mica substrate coated on its other side with a 0.1-0.2 micrometer thick layer of In₂O₃ or ZnO. The reflection R and transmission T factors of the attenuator were measured as functions of temperature and the power of the electric preheater. The radiation source was a HCN laser. Optical properties were computed from the measured values of R and T. The conducted experiments demonstrated the feasibility of amplitude-phase regulation of SMM radiation by the VO₂ film-mica structures. In particular, these structures can be used as smoothly adjustable attenuators for calibrated restriction of the power level in measurements of plasma parameters with the aid of SMM-lasers, which makes it possible markedly to broaden the range of these measurements. Figures 2; references 8: 6 Russian, 2 Western.
[22-1386]

USSR

UDC 621.396.61

HIGH-POWER SHORTWAVE RADIO BROADCAST TRANSMITTER

Moscow ELEKTROSVYAZ' No 8, Aug 79 pp 23-28 manuscript received 5 Sep 78

BURYAK, V. G. and KHVILIVITSKIY, T. G.

[Abstract] A study is made of the hardware and design peculiarities of single unit high-power shortwave radio broadcast transmitters. The designs of high-frequency stages and power supplies outlined in this article have allowed a significant increase in the maximum shortwave transmitter power while improving economical and operational characteristics of the devices. Figures 6; references 9 (Russian).
[19-6508]

USSR

UDC 533.924

LONGITUDINAL OSCILLATION OF A SEMICONDUCTOR PLASMA WITH A LOW CONCENTRATION OF CHARGE CARRIERS IN CROSSING FIELDS

Gorkiy IZV. VUZ: RADIOFIZIKA in Russian Vol 22 No 9, Sep 79 pp 1144-1151
manuscript received 6 Mar 78

KOLESOV, V. V., Ural State University

[Abstract] A nondegenerate semiconductor plasma is considered in two fields crossing at right angles, an electric one and a magnetic one, the latter being sufficiently strong to quantize the orbital motion of charge carriers. The electric field is just strong enough to heat the electron subsystem without affecting the state of an electron in the absence of scattering. The dielectric permittivity of such a homogeneous electron plasma is calculated for the case of a low concentration and thus also a non-Maxwellian energy distribution of charge carriers. Furthermore, potential oscillations in such a plasma are examined with the effect of electron heating and orbit quantization taken into account. Only longitudinal waves parallel to the magnetic field are considered, inasmuch as transverse waves are hardly affected by heating of the electrons, and the frequency spectrum as well as the amplitude decrement are determined from the dispersion equation. The results indicate a higher group velocity and a stronger attenuation of Langmuir waves due to the higher effective temperature, but the effect of heating on the attenuation is found to weaken and eventually vanish with decreasing wavelength. References 4 (Russian).
[51-2415]

USSR

UDC 621.382.2

MICROWAVE FIELD-INDUCED GENERATION OF LOW FREQUENCY ELECTROMAGNETIC OSCILLATIONS BY SEMICONDUCTOR DIODES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 24 No 8, 1979 pp 1702-1704

PRENTSLAU, N. N., DMITRIYEV, V. M. and BOBRYSHV, V. D.

[Abstract] The conditions under which not only amplification but also generation of low-frequency oscillations is observed on D501 silicon diodes and D602B germanium diodes in a microwave field are described. The generation is accompanied by a change--depending on the generation frequency--in the impedance of the diode installed in the waveguide duct, which results in a readily recordable low-frequency amplitude modulation of the passing

microwave signal. This effect can be utilized in systems for automatic frequency or phase control of a given microwave power level, as well as in the development of generators of sine-wave or pulse signals with electronic frequency retuning within extremely broad limits. As the experimental findings indicate, the overlap factor for the generation of sine-wave signals reaches 250, and for the generation of square pulses, 10^5 . Figures 3; references 4: 3 Russian, 1 Western.
[22-1386]

USSR

POLISH TRANSISTORS AND MICROCIRCUITS

Moscow RADIO in Russian No 3, Mar 79 pp 41

YUSTAT, YA.

[Abstract] Diodes and transistors have been produced in Poland since 1958 at the "Teva" Semiconductor Plant. The "Cemi" Scientific-Research Center for semiconductors was created in 1971. By 1975, 250 main types of semiconductors were in production in Poland, 90 percent of these being silicon diodes and transistors. The Polish semiconductor industry is now among the leading industries of its type in the world, producing millions of microcircuits per year. Analog devices include low-frequency amplifiers, stereophonic decoders, IF amplifiers and detectors; digital devices include all modern logic elements, over 110 types in all. LSI circuits for use in calculators and electronic clocks are also now in production. Several Polish made semiconductor devices are illustrated in photographs.

USSR

UDC 62-231.2

BUILDUP OF PERTURBATIONS WITH A LIMITED AMPLITUDE SPECTRUM

Leningrad IZV. VUZ: PRIBOROSTROYENIYE in Russian Vol 22 No 8, Aug 79 pp 27-30 manuscript received 7 Oct 78

KEYN, V. M. and PARIKOV, A. N.

[Abstract] A problem of perturbation buildup in linear dynamic systems, namely determining the maximum deviation, is solved by a simple new method for a closed system with constant parameters. Each component of the perturbation vector is represented by its Fourier transform with a limited amplitude spectrum but an unlimited phase spectrum. Accordingly, from the transfer function of such a system there is then calculated not only the maximum deviation but also the corresponding maximum perturbation causing it. An analytical expression for the latter is seldom obtainable, but numerical integration can always be performed. The method is demonstrated on the system $\ddot{x} + \dot{x} + x = v(t)$, $x(0) = 0$, $0 \leq t \leq T$. The paper was recommended by the Department (Kafedra) of Aircraft Instruments and Automatic Control Systems, Academy of Civil Aviation. Figures 2; references 3: 2 Russian, 1 Western.
[54-2415]

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